Waterproof, User-Removable Casings for Electronic Devices

Abstract:

This publication describes examples of casings for electronic devices, such as smartphones, that are user-removable while protecting device internals from the intrusion of dust, water, and/or the like. Removable casings advantageously allow users access to internal components, such as batteries, wireless charge flexes, SIM cards, memory cards, and so on. Removable casings, however, are typically not waterproof nor capable of protecting against other types of intrusions. Although it may be possible to improve intrusion protection using fasteners, such as screws, buttons, or latches, the use of such fasteners can preclude users from removing these types of casings by hand, without the aid of tools. Moreover, the use of fasteners can adversely impact the design and aesthetics of the electronic device. The electronic-device casings described herein are seamless and are capable of being removed by hand while protecting internal components. Examples of the described casings can be adapted to comply with one or more International Protection Code (IP Code) standards, such as IP68.

Keywords:

Electronic device, mobile computing device, smartphone, tablet, electronic device case, electronic device casing, phone case, removable phone case, removable case, phone casing, removable phone casing, removable casing, phone cover, removable phone cover, removable cover, back cover, removable back cover, removable phone backing, removable backing, waterproofing, International Protection Code, IP Code, IP68.
**Background:**

Removable casings can advantageously enable users to access internal components of electronic devices, such as smartphones. Most removable phone casings, however, are not waterproof and provide little protection from environmental intrusion. Although it may be possible to secure removable casings with fasteners, such as screws, buttons, latches, and/or the like, the use of such fasteners can preclude users from removing and/or replacing these types of casings by hand, or without the aid of tools. Fasteners can also adversely impact design and aesthetics. Therefore, it is desirable to provide removable casings for electronic devices that are waterproof, capable of being removed by hand, and do not involve externally visible fasteners.

**Description:**

Fig. 1-1 illustrates a side view of an exemplary electronic device 100 having a waterproof, removable casing 130 (a removable casing 130). The electronic device 100 may be a smartphone.

![Fig. 1-1 Electronic Device with Removable Casing](image)

A screen 112 may be disposed on a front side 110 of the electronic device 100 and a rear-facing camera 122 may be disposed on a back side 120 of the electronic device 100. The removable casing 130 covers a back portion of the electronic device 100. In Fig. 1-1, visible portions of the body 102 are highlighted with a diagonal fill pattern.
The removable casing 130 can securely attach to the body 102 of the electronic device 100. The removable casing 130 may be secured to the body 102 using any suitable mechanism. In the Fig. 1-1 example, the body 102 has an outward curvature 104. The removable casing 130 may be fabricated from a deformable material, such as a plastic, resin, plastic resin, and/or the like. The deformable material may enable the removable casing 130 to be securely attached to the body 102 (and detached therefrom) by hand. In some implementations, the removable casing 130 is configured to snap onto the outward curvature 104 of the body 102. As illustrated, the removable casing 130 may be constructed to form an outer curvature 134 configured to mate with and/or snap to the outward curvature 104 of the body 102 of the electronic device 100. Alternatively, the removable casing 130 may be configured to snap over the body 102 of the electronic device 100 (e.g., snap over a top or front edge of the body 102).

The removable casing 130 may include a first internal seal 140 that forms a waterproof seal between the removable casing 130 and the body 102 of the electronic device 100 (when the removable casing 130 is attached to the body 102 as illustrated in Fig. 1-1). The first internal seal 140 may be formed from any suitable material, including, but not limited to: silicone, latex, rubber, and/or other material(s) capable of forming a waterproof seal. The first internal seal 140 may be configured to form a waterproof seal around a perimeter of the electronic device 100 (e.g., around a junction between the removable casing 130 and the body 102 of the electronic device 100). The first internal seal 140 may be disposed within a channel formed within an inner surface of the removable casing 130. The removable casing 130 may include additional internal seals to form waterproof seals around components of the electronic device 100 that protrude from the removable casing 130. For example, a second internal seal (not shown in Fig. 1-1) may be configured to form a waterproof seal around the rear-facing camera 122 (and/or around a portion of the body 102).
adjacent to the rear-facing camera 122). The removable casing 130 may, therefore, prevent intrusion of water, dust, and other contaminants. The removable casing 130 may satisfy one or more IP Code standards, such as IP68.

The removable casing 130 may be fabricated in a two-shot injection molding process. The first shot may be plastic resin used to form the geometry and structure of the removable casing 130 and the second shot may be silicon used to form one or more internal seals, such as the first internal seal 140.

Fig. 1-2 illustrates a cross-sectional view of the electronic device 100 having a waterproof, user-removable casing 130. In Fig. 1-2, separation between the removable casing 130 and body 102 is for clarity of illustration; the removable casing 130 may be fit to the body 102 and/or other structural members of the electronic device 100, such that there is little or no separation therebetween.

![Fig. 1-2 Cross-Section of Electronic Device with Removable Casing](image)

**Fig. 1-2 Cross-Section of Electronic Device with Removable Casing**

As illustrated in Fig. 1-2, a first internal seal 140 may be disposed around a perimeter of the removable casing 130. The first internal seal 140 may be configured to form a waterproof seal between the removable casing 130 and the body 102. In the Fig. 1-2 example, the removable casing 130 further includes a second internal seal 142 disposed around an opening for the rear-facing camera 122 of the electronic device. The second internal seal 142 may be configured to
form a waterproof seal between the removable casing 130 and the rear-facing camera 122 and/or portion of the body 102 proximate to the rear-facing camera 122. An interior 106 of the electronic device 100 may be accessed by, *inter alia*, separating the removable casing 130 from the body 102. The removable casing 130 may be removed and replaced by hand (e.g., by prying the removable casing 130 from the body 102 and/or pressing the removable casing onto the body 102).

Fig. 1-3 illustrates a top-down view of the removable casing 130 when detached from the electronic device 100. As illustrated, the removable casing 130 may include a cutout 132 for the rear-facing camera 122 of the electronic device 100. The first internal seal 140 may be disposed around an internal perimeter of the removable casing 130. The removable casing 130 further includes a second internal seal 142 disposed around the cutout 132. The removable casing 130 may include additional internal seals to seal openings and/or cutouts for other components of the electronic device 100, such as interface ports, speakers, microphones, other cameras, and/or the like.

![Fig. 1-3: Top-Down View of Removable Casing](image)
Fig. 2 illustrates a cross-section of another example of a waterproof, user-removable casing 130 for an electronic device 100, such as a smartphone. In the Fig. 2 example, the removable casing 130 is configured to attach to an internal core or frame 222 of the electronic device 100. The removable casing 130 may be configured to securely couple with the internal frame 222 by, \textit{inter alia}, snapping onto an outer curvature of the internal frame 222. The removable casing 130 may be removed and replaced by hand. Removal may provide access to an interior 106 of the electronic device 100. In the Fig. 2 example, the removable casing 130 forms a substantially even and/or seamless junction 224 with outer surface(s) 202 of the electronic device 100 (and/or screen 102 of the electronic device 100).

\textbf{Fig. 2 Cross-Section View of Another Example of a Removable Casing}

The removable casing 130 may further include a first internal seal 140 configured to, \textit{inter alia}, form a waterproof seal between the removable casing 130 and the internal frame 222. The first internal seal 140 may be disposed within a channel or depression within the interior surface...
of the removable casing 130. The first internal seal 140 may be disposed along the perimeter of the removable casing 130, as illustrated in Fig. 1-3. The removable casing 130 may include additional internal seals to form waterproof seals between the internal frame 222 and one or more openings or cutouts formed in the removable casing 130, such as a second internal seal 142 around a cutout 132 for a rear-facing camera 122 of the electronic device 100 (not illustrated in Fig. 2). The first internal seal 140 and/or other internal seals of the removable casing 130 may enable the removable casing 130 to protect the electronic device 100 from intrusion by water, dust, and/or the like. The removable casing 130 illustrated in Fig. 2 may, therefore, comply with one or more IP Code standards, such as IP68.

In the Fig. 2 example, the removable casing 130 further includes plate member 230. The plate member 230 may be formed of a different material than the material(s) used to form the removable casing 130. In some examples, the plate member 230 is formed of glass, metal, or the like. The plate member 230 may be configured to strengthen, stiffen and/or increase the structural integrity of the removable casing 130. Alternatively, or in addition, the plate member 230 may enhance the design and/or aesthetics of the removable casing 130.

References: