ACOUSTIC FILTER AND ELECTRONIC DEVICE

TECHNICAL FIELD

[0001] This application relates to the field of semiconductor technologies, and in particular, to an acoustic filter and an electronic device.

[0002]

BACKGROUND

[0003] An acoustic filter is an important component for radio frequency signal processing, and is widely used in a radio frequency integrated circuit (RFIC) of a terminal device such as a mobile phone. A function of the acoustic filter is to block a signal at another frequency by using a signal at a specific frequency.

[0004] However, with integrated application of more frequency bands, filtering performance of the acoustic filter faces a greater challenge.

SUMMARY

[0005] Embodiments of this application provide an acoustic filter and an electronic device, to improve filtering performance of the acoustic filter.

[0006] To achieve the foregoing objective, this application uses the following technical solutions.

[0007] According to a first aspect, an acoustic filter is provided. The acoustic filter includes a first resonator, a second resonator, and a first acoustic wave suppression structure. The first resonator and the second resonator are arranged in a first direction. The first acoustic wave suppression structure is disposed between the first resonator and the second resonator, and at least one stopband generated by the first acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the first resonator and the second resonator and that is propagated in the first direction.

[0008] The acoustic filter provided in this application includes the first acoustic wave suppression structure disposed between the first resonator and the second resonator, and the at least one stopband generated by the first acoustic wave suppression structure is used to reduce the acoustic wave that is leaked between the first resonator and the second resonator and that is

propagated in the first direction. In other words, the at least one stopband generated by the first acoustic wave suppression structure may attenuate an acoustic wave that is of a specific frequency band of the acoustic filter and that is leaked from the first resonator and the second resonator. In this case, an acoustic wave that is of the specific frequency band of the acoustic filter and that is leaked from the first resonator may be suppressed from entering the second resonator, or an acoustic wave that is of the specific frequency band of the acoustic filter and that is leaked from the second resonator may be suppressed from entering the first resonator, so that filtering performance of the acoustic filter can be improved.

[0009] In a possible implementation, the first acoustic wave suppression structure includes at least one acoustic wave suppression unit group, each first acoustic wave suppression unit group in the at least one acoustic wave suppression unit group includes a plurality of acoustic wave suppression units, and the plurality of acoustic wave suppression units in the first acoustic wave suppression unit group are periodically arranged in the first direction, that is, the plurality of acoustic wave suppression units in the first acoustic wave suppression unit group are arranged in sequence in the first direction based at a same spacing.

[0010] When the acoustic wave suppression unit group includes the plurality of acoustic wave suppression units, and the plurality of acoustic wave suppression units in the acoustic wave suppression unit group are arranged in sequence in the first direction at the same spacing, that is, the plurality of acoustic wave suppression units in the acoustic wave suppression unit group are arranged periodically in the first direction, a spacing between the plurality of acoustic wave suppression units in the acoustic wave suppression unit group arranged in the first direction may be adjusted, to quickly and flexibly adjust a stopband generated by the acoustic wave suppression unit group, so that the at least one stopband generated by the first acoustic wave suppression structure can be used to reduce the acoustic wave that is leaked between the first resonator and the second resonator and that is propagated in the first direction.

[0011] In a possible implementation, the at least one acoustic wave suppression unit group includes a plurality of acoustic wave suppression unit groups; and spacings between two adjacent acoustic wave suppression units in different acoustic wave suppression unit groups are different. The spacings between two adjacent acoustic wave suppression units in different acoustic wave suppression unit groups are different. Therefore, when a material of the acoustic wave suppression unit is determined, different acoustic wave suppression unit groups correspondingly generate different stopbands, so that the first acoustic wave suppression structure can generate a plurality of stopbands.

[0012] In a possible implementation, a length that is of the first acoustic wave suppression structure and that is in a second direction is greater than a length that is of the first resonator and

that is in the second direction; and/or a length that is of the first acoustic wave suppression structure and that is in a second direction is greater than a length that is of the second resonator and that is in the second direction, where the first direction is perpendicular to the second direction. The length that is of the first acoustic wave suppression structure and that is in the second direction is greater than the length that is of the first resonator and that is in the second direction. In this case, it can be ensured that the first acoustic wave suppression structure can suppress, as far as possible, an acoustic wave that is leaked from the first resonator and that is propagated in the first direction, and it can be ensured that the first acoustic wave suppression structure can attenuate an acoustic wave leaked from the first resonator in an oblique direction. The length that is of the first acoustic wave suppression structure and that is in the second direction is greater than the length that is of the second resonator and that is in the second direction. In this case, it can be ensured that the first acoustic wave suppression structure can suppress, as far as possible, an acoustic wave that is leaked from the second resonator and that is propagated in the first direction, and it can be ensured that the first acoustic wave suppression structure can attenuate an acoustic wave leaked from the second resonator in the oblique direction.

[0013] In a possible implementation, a projection that is of the first acoustic wave suppression structure and that is in the first direction covers a projection that is of the first resonator and that is in the first direction; and/or a projection that is of the first acoustic wave suppression structure and that is in the first direction covers a projection that is of the second resonator and that is in the first direction. The projection that is of the first acoustic wave suppression structure and that is in the first direction covers the projection that is of the first resonator and that is in the first direction. This further ensures that the first acoustic wave suppression structure can suppress the acoustic wave that is leaked from the first resonator and that is propagated in the first direction, and ensures that a part that is outside the projection that is of the first resonator and that is in the first direction and that is of the projection that is of the first acoustic wave suppression structure and that is in the first direction can attenuate the acoustic wave leaked from the first resonator in the oblique direction. The projection that is of the first acoustic wave suppression structure and that is in the first direction covers the projection that is of the second resonator and that is in the first direction. This further ensures that the first acoustic wave suppression structure can suppress the acoustic wave that is leaked from the second resonator and that is propagated in the first direction, and ensures that a part that is outside the projection that is of the second resonator and that is in the first direction and that is of the projection that is of the first acoustic wave suppression structure and that is in the first direction can attenuate the acoustic wave leaked from the second resonator in the oblique direction.

[0014] In a possible implementation, the acoustic filter further includes a third resonator, the

second resonator and the third resonator are arranged in the second direction, and the first direction is perpendicular to the second direction. The plurality of acoustic wave suppression units in the first acoustic wave suppression structure include a plurality of first acoustic wave suppression units and a plurality of second acoustic wave suppression units. The first acoustic wave suppression unit is close to the first resonator, and the second acoustic wave suppression unit is close to the second resonator. The first acoustic wave suppression unit and the second acoustic wave suppression unit are both configured to reduce an acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce an acoustic wave that is leaked from the second resonator and that enters the first resonator. The first acoustic wave suppression unit is further configured to reduce an acoustic wave that is leaked from the first resonator and that enters the third resonator, or reduce an acoustic wave that is leaked from the third resonator and that enters the first resonator. When the acoustic filter includes the third resonator, and the second resonator and the third resonator are arranged in the second direction, there may be an acoustic wave leaked in the oblique direction in the first resonator, and the acoustic wave leaked in the oblique direction may affect the third resonator. Alternatively, there may be an acoustic wave leaked in the oblique direction in the third resonator, and the acoustic wave leaked in the oblique direction may affect the first resonator. However, in this embodiment of this application, the first acoustic wave suppression unit in the first acoustic wave suppression structure not only can reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator, but also can reduce the acoustic wave that is leaked from the first resonator and that enters the third resonator, or reduce the acoustic wave that is leaked from the third resonator and that enters the first resonator, so that the filtering performance of the acoustic filter can be improved.

[0015] In a possible implementation, the first acoustic wave suppression unit includes a first part and a second part, the second part is closer to the third resonator than the first part, a first end of the second part is connected to a first end of the first part, and the first part and the second part are not parallel. The first part can reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator. The second part or an intersection position of the first part and the second part can reduce an acoustic wave that is leaked from the first resonator in the oblique direction and that enters the third resonator, or reduce an acoustic wave that is leaked from the third resonator in the oblique direction and that enters the first resonator.

[0016] In a possible implementation, an included angle between the first part and the second part ranges from 90° to 165°, and an opening of the included angle between the first part and the second part faces the first resonator. When the included angle between the first part and the second

part ranges from 90° to 165°, the first acoustic wave suppression unit can more effectively reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator; and reduce the acoustic wave that is leaked from the first resonator in the oblique direction and that enters the third resonator, or reduce the acoustic wave that is leaked from the third resonator in the oblique direction and that enters the first resonator.

[0017] In a possible implementation, in a same acoustic wave suppression unit group, a spacing between adjacent first parts is equal to a spacing between adjacent second parts. In the same acoustic wave suppression unit group, the spacing between the adjacent first parts is equal to the spacing between the adjacent second parts. Therefore, in the same acoustic wave suppression unit group, a stopband generated by a plurality of first parts is the same as a stopband generated by a plurality of second parts. In this case, acoustic waves that are of a same frequency band and that are leaked from the first resonator may be suppressed by the plurality of first parts when leaked in the first direction, and may be suppressed by the plurality of second parts when leaked in the oblique direction, so that it is ensured that a stopband effect is basically the same in all directions, and a suppression effect of the first acoustic wave suppression unit is improved.

[0018] In a possible implementation, in the first direction, the first end of the first part is flush with the first resonator, or a projection that is of the first end of the first part and that is in the first direction is outside the first resonator. In the first acoustic wave suppression unit, the first part is mainly configured to suppress the acoustic wave that is leaked from the first resonator and that is propagated in the first direction, and the second part is mainly configured to suppress an acoustic wave that is leaked from the first resonator and that is propagated in the oblique direction. Therefore, when the first end of the first part is flush with the first resonator in the first direction, or the projection that is of the first end of the first part and that is in the first direction is outside the first resonator, it can be ensured that all acoustic waves that are leaked from the first resonator and that are propagated in the first direction can be suppressed by the first part.

[0019] In a possible implementation, the first acoustic wave suppression unit further includes a first connection part, the first connection part is disposed between the first part and the second part, one end of the first connection part is connected to the first end of the first part, and the other end is connected to the first end of the second part. The first connection part is configured, so that a problem that is caused by a sharp angle due to a direct connection between the first part and the second part and that affects the filtering performance of the acoustic filter can be avoided. In addition, process difficulty in manufacturing the first acoustic wave suppression unit can be reduced.

[0020] In a possible implementation, the acoustic filter further includes a second acoustic wave

suppression structure, the second acoustic wave suppression structure is disposed between the second resonator and the third resonator, and at least one stopband generated by the second acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the second resonator and the third resonator and that is propagated in the second direction. When the second acoustic wave suppression structure is designed, a specific frequency band of the acoustic filter may be covered by using the at least one stopband generated by the second acoustic wave suppression structure, to achieve an objective of reducing, by the at least one stopband generated by the second acoustic wave suppression structure, the acoustic wave that is leaked between the second resonator and the third resonator and that is propagated in the second direction, that is, reducing spur caused by the acoustic wave that is leaked between the second resonator and the third resonator and that is propagated in the second direction, so as to reduce an acoustic wave that is leaked from the second resonator and propagated in the second direction and that enters the third resonator or prevent the acoustic wave that is leaked from the second resonator and propagated in the second direction from entering the third resonator, or reduce an acoustic wave that is leaked from the third resonator and propagated in the second direction and that enters the second resonator or prevent the acoustic wave that is leaked from the third resonator and propagated in the second direction from entering the second resonator, so that the filtering performance of the acoustic filter is improved.

[0021] In a possible implementation, the acoustic filter further includes a fourth resonator, and the first resonator and the fourth resonator are arranged in the second direction. The second acoustic wave suppression unit is further configured to reduce an acoustic wave that is leaked from the second resonator and that enters the fourth resonator, or reduce an acoustic wave that is leaked from the fourth resonator and that enters the second resonator. When the acoustic filter further includes the fourth resonator, and the first resonator and the fourth resonator are arranged in the second direction, there may be an acoustic wave leaked in the oblique direction in the second resonator, and the acoustic wave leaked in the oblique direction may affect the fourth resonator. Alternatively, there may be an acoustic wave leaked in the oblique direction in the fourth resonator, and the acoustic wave leaked in the oblique direction may affect the second resonator. However, in this embodiment of this application, the second acoustic wave suppression unit not only can reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator, but also can reduce the acoustic wave that is leaked from the second resonator and that enters the fourth resonator, or reduce the acoustic wave that is leaked from the fourth resonator and that enters the second resonator, so that the filtering performance of the acoustic filter can be improved.

[0022] In a possible implementation, the second acoustic wave suppression unit includes a third part and a fourth part, the fourth part is closer to the fourth resonator than the third part, a first end of the fourth part is connected to a first end of the third part, and the third part and the fourth part are not parallel. The third part can reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator. The fourth part or an intersection position of the third part and the fourth part can reduce the acoustic wave that is leaked from the second resonator and that enters the fourth resonator, or reduce the acoustic wave that is leaked from the fourth resonator and that enters the second resonator.

[0023] In a possible implementation, an included angle between the third part and the fourth part ranges from 90° to 165°, and an opening of the included angle between the third part and the fourth part faces the second resonator. When the included angle between the third part and the fourth part ranges from 90° to 165°, the second acoustic wave suppression unit can more effectively reduce the acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce the acoustic wave that is leaked from the second resonator and that enters the first resonator; and reduce the acoustic wave that is leaked from the second resonator and that enters the fourth resonator, or reduce the acoustic wave that is leaked from the fourth resonator and that enters the second resonator.

[0024] In a possible implementation, in a same acoustic wave suppression unit group, a spacing between adjacent third parts is equal to a spacing between adjacent fourth parts. In the same acoustic wave suppression unit group, the spacing between the adjacent third parts is equal to the spacing between the adjacent fourth parts. Therefore, in the same acoustic wave suppression unit group, a stopband generated by a plurality of third parts is the same as a stopband generated by a plurality of fourth parts. In this case, acoustic waves that are of a same frequency band and that are leaked from the second resonator may be suppressed by the plurality of third parts when leaked in the first direction, and may be suppressed by the plurality of fourth parts when leaked in the oblique direction, so that it is ensured that a stopband effect is basically the same in all directions, and a suppression effect of the second acoustic wave suppression unit is improved.

[0025] In a possible implementation, in the first direction, the first end of the third part is flush with the second resonator, or a projection that is of the first end of the third part and that is in the first direction is outside the second resonator. In the second acoustic wave suppression unit, the third part is mainly configured to suppress the acoustic wave that is leaked from the second resonator and that is propagated in the first direction, and the fourth part is mainly configured to suppress the acoustic wave that is leaked from the second resonator and that is propagated in the oblique direction. Therefore, when the first end of the third part is flush with the second resonator

in the first direction, or the projection that is of the first end of the third part and that is in the first direction is outside the second resonator, it can be ensured that all acoustic waves that are leaked from the second resonator and that are propagated in the first direction can be suppressed by the third part.

[0026] In a possible implementation, the second acoustic wave suppression unit further includes a second connection part, the second connection part is disposed between the third part and the fourth part, one end of the second connection part is connected to the first end of the third part, and the other end of the second connection part is connected to the first end of the fourth part. The second connection part is configured, so that a problem that is caused by a sharp angle due to a direct connection between the third part and the fourth part and that affects the filtering performance of the acoustic filter can be avoided. In addition, process difficulty in manufacturing the second acoustic wave suppression unit can be reduced.

[0027] In a possible implementation, the plurality of first acoustic wave suppression units and the plurality of second acoustic wave suppression units are symmetrically disposed with respect to an axis of symmetry extending in the second direction. It can be ensured that a suppression effect of the first acoustic wave suppression structure on an acoustic wave leaked from the first resonator is the same as a suppression effect of the first acoustic wave suppression structure on an acoustic wave leaked from the second resonator, so that uniformity of the filtering performance of the acoustic filter can be improved.

[0028] In a possible implementation, the acoustic filter further includes a third acoustic wave suppression structure, the third acoustic wave suppression structure is disposed between the third resonator and the fourth resonator, and at least one stopband generated by the third acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the third resonator and the fourth resonator and that is propagated in the first direction. The acoustic filter further includes the third acoustic wave suppression structure disposed between the third resonator and the fourth resonator, and the at least one stopband generated by the third acoustic wave suppression structure is used to reduce the acoustic wave that is leaked between the third resonator and the fourth resonator and that is propagated in the first direction. In other words, the at least one stopband generated by the third acoustic wave suppression structure may attenuate an acoustic wave that is of a specific frequency band of the acoustic filter and that is leaked from the third resonator and the fourth resonator. In this case, an acoustic wave that is of the specific frequency band of the acoustic filter and that is leaked from the third resonator may be suppressed from entering the fourth resonator, or an acoustic wave that is of a specific frequency band of the acoustic filter and that is leaked from the fourth resonator may be suppressed from entering the third resonator, so that the filtering performance of the acoustic filter is ensured.

[0029] In a possible implementation, the acoustic filter further includes a fourth acoustic wave suppression structure, the fourth acoustic wave suppression structure is disposed between the first resonator and the fourth resonator, and at least one stopband generated by the fourth acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the first resonator and the fourth resonator and that is propagated in the second direction. When the fourth acoustic wave suppression structure is designed, a specific frequency band of the acoustic filter may be covered by using the at least one stopband generated by the fourth acoustic wave suppression structure, to achieve an objective of reducing, by the at least one stopband generated by the fourth acoustic wave suppression structure, the acoustic wave that is leaked between the first resonator and the fourth resonator and that is propagated in the second direction, so as to reduce an acoustic wave that is leaked from the first resonator and propagated in the second direction and that enters the fourth resonator or prevent the acoustic wave that is leaked from the first resonator and propagated in the second direction from entering the fourth resonator, or reduce an acoustic wave that is leaked from the fourth resonator and propagated in the second direction and that enters the first resonator or prevent the acoustic wave that is leaked from the fourth resonator and propagated in the second direction from entering the first resonator, so that the filtering performance of the acoustic filter is improved.

[0030] In a possible implementation, the first resonator is a surface acoustic wave resonator, and/or the second resonator is a surface acoustic wave resonator. The surface acoustic wave resonator includes an interdigital transducer, where the interdigital transducer includes a first busbar and a second busbar that are disposed opposite to each other, a plurality of first electrode fingers that are arranged in sequence in the first direction and that are in contact with the first busbar, and a plurality of second electrode fingers that are arranged in sequence in the first direction and that are in contact with the second busbar, where the first electrode finger and the second electrode finger are alternately arranged in sequence in the first direction.

[0031] In a possible implementation, the first resonator is a bulk acoustic wave resonator, and/or the second resonator is a bulk acoustic wave resonator.

[0032] According to a second aspect, an acoustic filter is provided. The acoustic filter includes a first resonator, a second resonator, and a first acoustic wave suppression structure. The first resonator and the second resonator are arranged in a first direction, and an acoustic wave propagated in the first direction may be generated inside the first resonator, and/or an acoustic wave propagated in the first direction may be generated inside the second resonator. The first acoustic wave suppression structure is disposed between the first resonator and the second resonator, the first acoustic wave suppression structure includes at least one acoustic wave suppression unit group, each first acoustic wave suppression unit group in the at least one acoustic

wave suppression unit group includes a plurality of acoustic wave suppression units, and the plurality of acoustic wave suppression units in the first acoustic wave suppression unit group are periodically arranged in the first direction. The first acoustic wave suppression structure is disposed between the first resonator and the second resonator of the acoustic filter, the first acoustic wave suppression structure includes the at least one acoustic wave suppression unit group, each first acoustic wave suppression unit group includes the plurality of acoustic wave suppression units, and the plurality of acoustic wave suppression units are arranged periodically in the first direction. Therefore, a spacing between the plurality of acoustic wave suppression units in the acoustic wave suppression unit group in the first direction is adjusted, to quickly and flexibly adjust a stopband generated by the acoustic wave suppression unit group, so that the stopband generated by the plurality of acoustic wave suppression units that are periodically arranged in the first direction can be used to reduce an acoustic wave that is leaked between the first resonator and the second resonator and that is propagated in the first direction, and filtering performance of the acoustic filter is improved.

[0033] According to a third aspect, an electronic device is provided. The electronic device includes an acoustic filter, a processor, and a printed circuit board. Both the acoustic filter and the processor are disposed on the printed circuit board, and the acoustic filter is the acoustic filter provided in the first aspect. The electronic device has a same technical effect as the acoustic filter provided in the first aspect. For details, refer to related descriptions of the first aspect. Details are not described herein again.

BRIEF DESCRIPTION OF DRAWINGS

[0034] FIG. 1 is a diagram of a structure of an electronic device according to an embodiment of this application;

[0035] FIG. 2 is a diagram of a structure of an acoustic filter;

[0036] FIG. 3a is a diagram of a structure of an acoustic filter according to an embodiment of this application;

[0037] FIG. 3b is a diagram of a structure of an acoustic filter according to another embodiment of this application;

[0038] FIG. 4a is a diagram of a structure of an acoustic filter according to a related technology;

[0039] FIG. 4b is a diagram of a structure of an acoustic filter according to another related technology;

[0040] FIG. 5 is a curve diagram of a relationship between a frequency and a transmission function S31;

[0041] FIG. 6a is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0042] FIG. 6b is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0043] FIG. 6c is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0044] FIG. 7 is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0045] FIG. 8 is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0046] FIG. 9 is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0047] FIG. 10 is a diagram of a structure of a first acoustic wave suppression structure according to an embodiment of this application;

[0048] FIG. 11 is a diagram of a structure of a first acoustic wave suppression structure according to another embodiment of this application;

[0049] FIG. 12 is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0050] FIG. 13a is a diagram of a structure of a first acoustic wave suppression structure according to still another embodiment of this application;

[0051] FIG. 13b is a diagram of a structure of a first acoustic wave suppression structure according to still another embodiment of this application;

[0052] FIG. 14 is a diagram of a structure of an acoustic filter according to still another embodiment of this application;

[0053] FIG. 15 is a diagram of a structure of an acoustic filter according to still another embodiment of this application; and

[0054] FIG. 16 is a diagram of a structure of an acoustic filter according to still another embodiment of this application.

[0055] 1-Electronic device; 10-Acoustic filter; 11-Cover plate; 12-Display screen; 13-Middle frame; 14-Rear housing; 101-First resonator; 102-Second resonator; 103-First acoustic wave suppression structure; 103a-Acoustic wave suppression unit group; 104-Irregular pattern; 105-Third resonator; 106-Second acoustic wave suppression structure; 107-Fourth resonator; 108-Third acoustic wave suppression structure; 109-Fourth acoustic wave suppression structure; 131-Bearing plate; 132-Frame; 1011-Interdigital transducer; 1012-Reflector; 1011a-First busbar; 1011b-Second busbar; 1011c-First Electrode finger; 1011d-Second electrode finger; 1012a-

Grating; 1012b-Third busbar; 1031-Acoustic wave suppression unit; 1031a-First acoustic wave suppression unit; 1031b-Second acoustic wave suppression unit; 10311a-First part; 10312a-Second part; 10313a-First connection part; 10311b-Third part; 10312b-Fourth part; and 10313b-Second connection part.

DESCRIPTION OF EMBODIMENTS

[0056] The following describes the technical solutions in embodiments of this application with reference to the accompanying drawings in embodiments of this application. It is clear that the described embodiments are merely a part rather than all of embodiments of this application.

[0057] The terms such as "first" and "second" mentioned below are merely for convenience of description, and shall not to be understood as an indication or implication of relative importance or implicit indication of a quantity of indicated technical features. Therefore, a feature limited by "first", "second", or the like may explicitly or implicitly include one or more features. In descriptions of this application, unless otherwise stated, "a plurality of" means two or more than two.

[0058] In embodiments of this application, the word such as "example" or "for example" is used to represent giving an example, an illustration, or a description. Any embodiment or design scheme described as an "example" or "for example" in embodiments of this application should not be explained as being more preferred or having more advantages than another embodiment or design scheme. Exactly, use of the word such as "example" or "for example" is intended to present a relative concept in a specific manner.

[0059] In embodiments of this application, "and/or" describes an association relationship between associated objects, and represents that three relationships may exist. For example, A and/or B may represent the following cases: Only A exists, both A and B exist, and only B exists, where A and B may be singular or plural. The character "/" generally indicates an "or" relationship between the associated objects.

[0060] An embodiment of this application provides an electronic device. The electronic device may be, for example, different types of user equipment or terminal devices such as a mobile phone, a tablet computer (pad), a personal digital assistant (PDA), a television, an intelligent wearable product (for example, a smartwatch or a smart band), a virtual reality (VR) terminal device, an augmented reality (AR) terminal device, a small charging household appliance (for example, a soybean milk machine or a vacuum cleaning robot), an uncrewed aerial vehicle, a radar, an aerospace device, and a vehicle-mounted device. A specific form of the electronic device is not specially limited in this embodiment of this application.

[0061] For ease of description, the following uses an example in which the electronic device is a mobile phone for description. As shown in FIG. 1, an electronic device 1 mainly includes a cover plate 11, a display screen 12, a middle frame 13, and a rear housing 14. The rear housing 14 and the display screen 12 are respectively located on two sides of the middle frame 13, the middle frame 13 and the display screen 12 are disposed in the rear housing 14, the cover plate 11 is disposed on a side that is of the display screen 12 and that is away from the middle frame 13, and a display surface of the display screen 12 faces the cover plate 11.

[0062] The display screen 12 may be a liquid crystal display (LCD). In this case, the liquid crystal display includes a liquid crystal display panel and a backlight module. The liquid crystal display panel is disposed between the cover plate 11 and the backlight module, and the backlight module is configured to provide a light source for the liquid crystal display panel. Alternatively, the display screen 12 may be an organic light-emitting diode (OLED) display screen. Because the OLED display screen is a self-luminous display screen, a backlight module does not need to be disposed.

[0063] The middle frame 13 includes a bearing plate 131 and a frame 132 that surrounds the bearing plate 131. Electronic components such as a printed circuit board (PCB), a battery, and a camera in the electronic device 1 may be disposed on the bearing plate 131.

[0064] The electronic device 1 may further include a system-on-chip (SoC), a radio frequency chip, and the like that are disposed on the PCB. The PCB is configured to bear the system-on-chip, the radio frequency chip, and the like, and is electrically connected to the system-on-chip, the radio frequency chip, and the like. The radio frequency chip may include parts such as an acoustic filter and a processor. The processor is configured to process various signals. The acoustic filter is an important part of radio frequency signal processing, and is configured to block a signal at another frequency by using a signal at a specific frequency.

[0065] With integrated application of more frequency bands, filtering performance of the acoustic filter faces a greater challenge. Research has found that spurs affect the filtering performance. A structure of the acoustic filter mainly includes a plurality of resonators. Faced with a trend of increasing miniaturization of a chip, layout space needs to be fully used in an internal layout of the acoustic filter. Inevitably, as shown in FIG. 2, a layout manner in which two or more resonators are disposed on a same horizontal plane occurs. However, when an acoustic wave inside the resonator is horizontally propagated, a problem that an acoustic wave propagated inside one resonator is leaked and enters another resonator usually occurs. For example, as shown in FIG. 2, an acoustic wave propagated inside a resonator A is leaked and enters a resonator B. In this case, a spur between the acoustic wave that is leaked from the resonator A and that enters the resonator B and an acoustic wave generated inside the resonator B affects filtering performance of an entire

acoustic filter. Therefore, it is necessary to find ways to suppress such leaked acoustic wave energy. However, it is further found that, in the acoustic filter, if the acoustic wave leaked between the resonator A and the resonator B is suppressed, the spur can be reduced, so that the filtering performance of the acoustic filter can be improved.

[0066] In view of this, an embodiment of this application provides an acoustic filter. The acoustic filter may be used in the foregoing electronic device 1. The acoustic filter provided in this embodiment of this application may be, for example, a low-pass acoustic filter, a high-pass acoustic filter, a band-pass acoustic filter, a band-stop acoustic filter, or an active acoustic filter.

[0067] As shown in FIG. 3a, an acoustic filter 10 provided in an embodiment of this application includes a first resonator 101 and a second resonator 102. The first resonator 101 and the second resonator 102 are arranged in a first direction X. An acoustic wave propagated in the first direction X may be generated inside the first resonator 101, and/or an acoustic wave propagated in the first direction X may be generated inside the second resonator 102.

[0068] Herein, the first resonator 101 and the second resonator 102 may be, for example, surface acoustic wave (SAW) resonators or bulk acoustic wave (BAW) resonators. In addition, a type of the first resonator 101 and a type of the second resonator 102 may be the same, for example, both are surface acoustic wave resonators, or both are bulk acoustic wave resonators. Certainly, the type of the first resonator 101 and the type of the second resonator 102 may be different. For example, one of the first resonator 101 and the second resonator 102 is a surface acoustic wave resonator, and the other is a bulk acoustic wave resonator.

[0069] For ease of description, in the accompanying drawings of the specification, an example in which both the first resonator 101 and the second resonator 102 are surface acoustic wave resonators is used for illustration. When both the first resonator 101 and the second resonator 102 are surface acoustic wave resonators, as shown in FIG. 3a, the surface acoustic wave resonator includes an interdigital transducer (IDT) 1011 disposed on a piezoelectric substrate or a piezoelectric thin film and reflectors 1012 disposed on two sides of the interdigital transducer 1011 in the first direction X. The interdigital transducer 1011 includes a first busbar 1011a and a second busbar 1011b that are disposed opposite to each other in a second direction, where the first direction is perpendicular to the second direction, and both the first busbar 1011a and the second busbar 1011b extend in the first direction X. The interdigital transducer 1011 further includes a plurality of first electrode fingers 1011c and a plurality of second electrode fingers 1011d. The plurality of first electrode fingers 1011c are arranged in sequence in the first direction X, and are electrically connected to the first busbar 1011a. The plurality of second electrode fingers 1011d are arranged in sequence in the first direction X, and are electrically connected to the second busbar 1011b. The first electrode finger 1011c and the second electrode finger 1011d are alternately

disposed in the first direction X. The reflector 1012 may include a plurality of gratings 1012a arranged in sequence in the first direction X, and the plurality of gratings 1012a may be electrically connected together by using one or two third busbars 1012b extending in the first direction X.

[0070] An operating principle of the surface acoustic wave resonator is as follows: An alternating electric field is loaded to the interdigital transducer 1011, and various surface acoustic waves may be generated through excitation on the piezoelectric substrate or along the piezoelectric thin film based on piezoelectric effect. Different types of acoustic waves have different frequencies and electromechanical coupling coefficients k^2. A type of the acoustic wave generated through excitation is determined by both an alternating frequency and a Euler angle of a piezoelectric material. The interdigital transducer 1011 has advantages such as a simple preparation process, high acoustic-electric conversion efficiency, and a flexible setting of an operating frequency.

[0071] That "an acoustic wave propagated in the first direction X may be generated inside the first resonator 101, and/or an acoustic wave propagated in the first direction X may be generated inside the second resonator 102" may mean that the acoustic wave propagated in the first direction X is generated inside the first resonator 101, and the acoustic wave propagated in the first direction X cannot be generated inside the second resonator 102; or may mean that the acoustic wave propagated in the first direction X is generated inside the second resonator 102, and the acoustic wave propagated in the first direction X cannot be generated inside the first resonator 101; or may certainly mean that the acoustic wave propagated in the first direction X is generated inside both the first resonator 101 and the second resonator 102. It may be understood that acoustic waves including but not limited to the acoustic wave propagated in the first direction X may be generated inside the first resonator 101 and the second resonator 102. An acoustic wave propagated in another direction may also be generated. For example, when the first resonator 101 and the second resonator 102 are bulk acoustic wave resonators, a bulk acoustic wave may also be generated inside the first resonator 101 and the second resonator 102.

[0072] Still refer to FIG. 3a. The acoustic filter 10 provided in this embodiment of this application further includes a first acoustic wave suppression structure 103, the first acoustic wave suppression structure 103 is disposed between the first resonator 101 and the second resonator 102, and at least one stopband generated by the first acoustic wave suppression structure 103 is used to reduce an acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce a spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X.

[0073] It should be understood that, in this embodiment of this application, a reason why the at least one stopband generated by the first acoustic wave suppression structure 103 can be used

to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X is as follows: The at least one stopband generated by the first acoustic wave suppression structure 103 covers a specific frequency band of the acoustic filter 10, and the specific frequency band of the acoustic filter 10 is related to key performance specified by the acoustic filter 10, where the key performance may include, for example, out-of-band suppression. The key performance specified by the acoustic filter 10 may be related to one or more specific frequency bands of the acoustic filter 10. For any acoustic filter 10, key performance of the acoustic filter 10 may vary with a use scenario, a function, and the like of the acoustic filter 10. Therefore, a specific frequency band of the acoustic filter 10 should be selected as required. For example, the specific frequency band of the acoustic filter 10 may be 710 MHz to 750 MHz. For another example, the specific frequency band of the acoustic filter 10 may be 820 MHz to 840 MHz. When the acoustic filter 10 is designed, the stopband generated by the first acoustic wave suppression structure 103 is set based on the specific frequency band of the acoustic filter 10.

[0074] It may be understood that the first acoustic wave suppression structure 103 may generate one stopband for reducing the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X. Alternatively, the first acoustic wave suppression structure 103 may generate a plurality of stopbands for reducing the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X. In addition, there may be one or more specific frequency bands of the acoustic filter 10. The first acoustic wave suppression structure 103 may generate one stopband for covering the one or more specific frequency bands of the acoustic filter 10. Alternatively, the first acoustic wave suppression structure 103 may generate a plurality of stopbands for covering the one or more specific frequency bands of the acoustic filter 10.

[0075] It should be noted that, the stopband generated by the first acoustic wave suppression structure 103 is related to factors such as a material and a structure of the first acoustic wave suppression structure 103. Therefore, when the first acoustic wave suppression structure 103 is designed, the material, the structure, and the like of the first acoustic wave suppression structure 103 may be adjusted to adjust the stopband generated by the first acoustic wave suppression structure 103, or the material, the structure, and the like of the first acoustic wave suppression structure 103 may be adjusted to adjust the one or more stopbands generated by the first acoustic wave suppression structure 103.

[0076] It should be understood that the material of the first acoustic wave suppression structure 103 is a conductive material. In addition, the material of the first acoustic wave suppression structure 103 may be the same as or different from a material of an electrode in the first resonator

101 and a material of an electrode in the second resonator 102.

[0077] In this embodiment of this application, considering that the first resonator 101 and the second resonator 102 are arranged in the first direction X, and the acoustic wave propagated in the first direction X may be generated inside the first resonator 101, and/or the acoustic wave propagated in the first direction X may be generated inside the second resonator 102, a case in which the acoustic wave propagated in the first direction X inside the first resonator 101 is leaked and enters the second resonator 102 may occur, or a case in which the acoustic wave propagated in the first direction X inside the second resonator 102 is leaked and enters the first resonator 101 may occur. As a result, filtering performance of the acoustic filter 10 is affected. Especially, with a trend of increasing miniaturization of a chip, layout space needs to be fully used in an internal layout of the filter. Therefore, a distance that is between the first resonator 101 and the second resonator 102 and that is in the first direction X is further reduced. As a result, the case in which the acoustic wave propagated in the first direction X inside the first resonator 101 is leaked and enters the second resonator 102 inevitably occurs, or the case in which the acoustic wave propagated in the first direction X inside the second resonator 102 is leaked and enters the first resonator 101 inevitably occurs. For the surface acoustic wave resonator, the reflectors 1012 on the two sides of the interdigital transducer 1011 may constrain an acoustic wave within the interdigital transducer 1011. However, a constraint effect is related to many factors such as a quantity of pairs of reflectors 1012 and a periodicity of the reflector 1012, and a problem that the acoustic wave propagated in the first direction X inside the first resonator 101 or the acoustic wave propagated in the first direction X inside the second resonator 102 is leaked may still occur.

[0078] Based on the foregoing descriptions, in this embodiment of this application, to avoid the case in which the acoustic wave propagated in the first direction X inside the first resonator 101 is leaked and enters the second resonator 102 or the case in which the acoustic wave propagated in the first direction X inside the second resonator 102 is leaked and enters the first resonator 101, the acoustic filter 10 provided in this embodiment of this application further includes the first acoustic wave suppression structure 103 disposed between the first resonator 101 and the second resonator 102, and the at least one stopband generated by the first acoustic wave suppression structure 103 is used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, in other words, the at least one stopband generated by the first acoustic wave suppression structure 103 may be used to attenuate acoustic waves that are of the specific frequency band of the acoustic filter 10 and that are leaked from the first resonator 101 and the second resonator 102. In this case, the acoustic wave that is of

the specific frequency band of the acoustic filter 10 and that is leaked from the first resonator 101 can be suppressed from entering the second resonator 102, or the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the second resonator 102 can be suppressed from entering the first resonator 101, so that the filtering performance of the acoustic filter 10 can be improved.

[0079] To avoid the case in which the acoustic wave propagated in the first direction X inside the first resonator 101 is leaked and enters the second resonator 102, or the case in which the acoustic wave propagated in the first direction X inside the second resonator 102 is leaked and enters the first resonator 101, a related technology provides an acoustic filter. As shown in FIG. 4a, in addition to the first resonator 101 and the second resonator 102, the acoustic filter 10 further includes an irregular pattern 104 disposed between the first resonator 101 and the second resonator 102. A cross-sectional shape of the irregular pattern 104 includes a wavy shape, a diamond shape, a square shape, a circle shape, or the like. Diffuse reflection of an acoustic wave signal is implemented by using the irregular pattern 104, so that an objective of suppressing an acoustic wave propagated inside the first resonator 101 from being leaked and entering the second resonator 102 or an acoustic wave propagated inside the second resonator 102 from being leaked and entering the first resonator 101 is achieved. However, an effect of suppressing, through diffuse reflection implemented by using the irregular pattern 104, a signal from being leaked is poor, and the leaked signal still affects the filtering performance of the acoustic filter 10. In comparison with the related technology, in this embodiment of this application, the first acoustic wave suppression structure 103 is disposed between the first resonator 101 and the second resonator 102, and the at least one generated stopband is used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, so that the acoustic waves that are of the specific frequency band of the acoustic filter 10 and that are leaked from the first resonator 101 and the second resonator 102 are attenuated. In this case, the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the first resonator 101 can be suppressed from entering the second resonator 102, or the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the second resonator 102 can be suppressed from entering the first resonator 101, so that a problem that an acoustic wave leaked from the first resonator 101 or an acoustic wave leaked from the second resonator 102 affects the filtering performance of the acoustic filter 10 can be relieved or avoided.

[0080] Another related technology provides an acoustic filter. A first resonator 101 and a second resonator 102 in the acoustic filter are surface acoustic wave resonators. A principle of

constraining a signal by using a reflector 1012 in the surface acoustic wave resonator is a stopband effect. In a stopband frequency range, it may be considered that the reflector 1012 performs total reflection on an acoustic wave signal. Based on this, as shown in FIG. 4b, in the related technology, the reflector 1012 is divided into three parts: 1012c, 1012d, and 1012e. Each part has a different periodicity, to be specific, spacings between adjacent gratings 1012a of the three parts are different. In this case, the three parts may each generate one stopband. Therefore, the reflector 1012 can generate three stopbands. In comparison with a conventional technology in which spacings between reflectors 1012 are the same and the reflector 1012 can generate only one stopband, the related technology can extend a frequency range of the total reflection of the reflector 1012. However, a disadvantage of the related technology is that a frequency suppression range is limited, and it is possible that the acoustic wave of a specific frequency band of the acoustic filter 10 may be leaked. However, the specific frequency band of the acoustic filter 10 is related to key performance specified by the acoustic filter 10. Therefore, filtering performance of the acoustic filter 10 is still affected. In addition, a shape design of the reflector 1012 cannot be randomly adjusted. However, in this embodiment of this application, the at least one stopband generated by the first acoustic wave suppression structure 103 is used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, to reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X. Therefore, parameters such as a shape, the structure, and the material of the first acoustic wave suppression structure 103 may be randomly adjusted to adjust the stopband generated by the first acoustic wave suppression structure 103. The specific frequency band of the acoustic filter 10 is covered by using the at least one stopband generated by the first acoustic wave suppression structure 103, so that the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the first resonator 101 and the second resonator 102 is attenuated. In this case, the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the first resonator 101 can be suppressed from entering the second resonator 102, or the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the second resonator 102 can be suppressed from entering the first resonator 101, so that the problem that the acoustic wave leaked from the first resonator 101 or the acoustic wave leaked from the second resonator 102 affects the filtering performance of the acoustic filter 10 can be relieved or avoided.

[0081] FIG. 5 is obtained through analog simulation. Refer to FIG. 5. A curve a in FIG. 5 is a curve of a relationship between a frequency of the acoustic filter 10 (where the first acoustic wave suppression structure 103 is disposed between the first resonator 101 and the second resonator 102)

that is provided in this embodiment of this application and that is shown in FIG. 3a and a transmission function S31. A curve b in FIG. 5 is a curve of a relationship between a frequency of the acoustic filter 10 (where the irregular pattern 104 is disposed between the first resonator 101 and the second resonator 102) that is provided in the related technology and that is shown in FIG. 4a and the transmission function S31. A curve c in FIG. 5 is a curve of a relationship between a frequency of the acoustic filter 10 in which no acoustic wave suppression structure is disposed between the first resonator 101 and the second resonator 102 and the transmission function S31. A curve d in FIG. 5 is a curve of a relationship between a frequency of the first acoustic wave suppression structure 103 in this embodiment of this application and the transmission function S31, and the curve d indicates a stopband generated by the first acoustic wave suppression structure 103, where the stopband generated by the first acoustic wave suppression structure 103 is 705 MHz to 758 MHz. A curve e in FIG. 5 is a curve of a relationship between a frequency of the irregular pattern 104 in the related technology shown in FIG. 4a and the transmission function S31, and the curve e indicates a stopband generated by using the irregular pattern 104, where the stopband generated by using the irregular pattern 104 is 670 MHz to 718 MHz. A curve f in FIG. 5 is a curve of a relationship between a frequency of a reflector in a surface acoustic wave resonator and the transmission function S31, and the curve f indicates a stopband generated by the reflector, where the stopband generated by the reflector is 780 MHz to 840 MHz. It should be noted that, in an analog simulation process, a periodicity of the irregular pattern 104 in FIG. 4a is 1.06 times a periodicity of the first acoustic wave suppression structure 103 in FIG. 3a. During actual manufacturing, the periodicity of the irregular pattern 104 is far greater than the periodicity of the first acoustic wave suppression structure 103 in FIG. 3a. In addition, in FIG. 5, left vertical coordinates are vertical coordinates of the curve a, the curve b, and the curve c, and right vertical coordinates are vertical coordinates of the curve d, the curve e, and the curve f.

[0082] It can be learned from the curve a, the curve b, and the curve c in FIG. 5 that a frequency band of a passband of the acoustic filter 10 is 760 MHz to 815 MHz. In FIG. 5, an example in which a left side of the passband of the acoustic filter 10 is a key performance position of the acoustic filter 10, in other words, the specific frequency band of the acoustic filter 10 is 718 MHz to 750 MHz, is used. It can be learned through comparison between the curve a, the curve b, and the curve c that, in the frequency band from 718 MHz to 750 MHz, on the curve a, the transmission function S31 of the acoustic filter 10 provided in this embodiment of this application is less than –50 dB. However, on the curve b and the curve c, a case in which the transmission function S31 of the acoustic filter 10 is greater than –50 dB exists. This indicates that the stopband generated by the first acoustic wave suppression structure 103 in the acoustic filter 10 provided in this embodiment of this application can reduce the acoustic wave that is leaked between the first

resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X. It can be learned from the curve d that, the stopband generated by the first acoustic wave suppression structure 103 in the acoustic filter 10 provided in this embodiment of this application is 705 MHz to 758 MHz, and the stopband generated by the first acoustic wave suppression structure 103 covers the specific frequency band of the acoustic filter 10. Therefore, the first acoustic wave suppression structure 103 in this embodiment of this application can effectively reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, so that the out-of-band suppression can reach 50 dB. It can be learned from the curve e that, the stopband generated by using the irregular pattern 104 is 670 MHz to 718 MHz, and the stopband generated by using the irregular pattern 104 does not cover the specific frequency band of the acoustic filter 10. Therefore, an effect of reducing, through diffuse reflection implemented by using the irregular pattern 104, the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X is poor. It can be learned from the curve f that, for the surface acoustic wave resonator, a stopband generated by a reflector is 780 MHz to 840 MHz. In this case, the reflector can suppress only acoustic waves whose frequency band is 780 MHz to 840 MHz, and when the specific frequency band of the acoustic filter 10 is not in a range of 780 MHz to 840 MHz, for example, as shown in FIG. 5, when the specific frequency band of the acoustic filter 10 is 718 MHz to 750 MHz, the acoustic wave leaked between the first resonator 101 and the second resonator 102 still causes the spur. However, in this embodiment of this application, the at least one stopband generated by the first acoustic wave suppression structure 103 is used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X. Therefore, when the first acoustic wave suppression structure 103 is designed, the at least one stopband generated by the first acoustic wave suppression structure 103 can cover the specific frequency band of the acoustic filter 10, so that an objective that the at least one stopband generated by the first acoustic wave suppression structure 103 is used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X, is achieved.

[0083] It should be noted that a specific structure of the first acoustic wave suppression structure 103 is not limited in this application, provided that the at least one stopband generated by the first acoustic wave suppression structure 103 can be used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X.

[0084] In some examples, as shown in FIG. 3a, the first acoustic wave suppression structure 103 includes at least one acoustic wave suppression unit group 103a, and each first acoustic wave suppression unit group 103a in the at least one acoustic wave suppression unit group 103a includes a plurality of acoustic wave suppression units 1031. The plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are arranged in sequence in the first direction X at a same spacing h, that is, the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are periodically arranged in the first direction X.

[0085] Herein, the first acoustic wave suppression structure 103 may include one acoustic wave suppression unit group 103a, as shown in FIG. 3a. The first acoustic wave suppression structure 103 may alternatively include a plurality of acoustic wave suppression unit groups 103a, as shown in FIG. 3b. In FIG. 3b, an example in which the first acoustic wave suppression structure 103 includes two acoustic wave suppression unit groups 103a is used for illustration. For ease of description, the following uses an example in which the first acoustic wave suppression structure 103 includes one acoustic wave suppression unit group 103a.

[0086] When the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression unit groups 103a, that is, the at least one acoustic wave suppression unit group includes a plurality of acoustic wave suppression unit groups 103a, spacings h between two adjacent acoustic wave suppression units 1031 in different acoustic wave suppression unit groups 103a are different.

[0087] It may be understood that, for each acoustic wave suppression unit group 103a, a material of the acoustic wave suppression unit 1031 in the acoustic wave suppression unit group 103a, the spacing h at which the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are arranged in the first direction X, and the like may be adjusted to adjust a stopband generated by the acoustic wave suppression unit group 103a. In the acoustic wave suppression unit group 103a, the spacing h between two adjacent acoustic wave suppression units 1031 affects the stopband generated by the acoustic wave suppression unit group 103a. The spacings h between two adjacent acoustic wave suppression units 1031 in different acoustic wave suppression unit groups 103a are different. Therefore, when the material of the acoustic wave suppression unit 1031 is determined, different acoustic wave suppression unit groups 103a correspondingly generate different stopbands, so that the first acoustic wave suppression structure

103 can generate a plurality of stopbands. If the first acoustic wave suppression structure 103 includes one acoustic wave suppression unit group 103a, the first acoustic wave suppression structure 103 correspondingly generates one stopband. If the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression unit groups 103a, the first acoustic wave suppression structure 103 correspondingly generates a plurality of stopbands.

[0088] Herein, a quantity of the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a may be set as required. It may be understood that the specified quantity of acoustic wave suppression units 1031 should ensure that a leaked acoustic wave can be attenuated enough.

[0089] In addition, a cross-sectional shape of the acoustic wave suppression unit 1031 may be, for example, a diamond shape shown in FIG. 3a. For another example, a cross-sectional shape of the acoustic wave suppression unit 1031 may be an oval shape shown in FIG. 6a. For another example, a cross-sectional shape of the acoustic wave suppression unit 1031 may be a square shape shown in FIG. 6b. For another example, a cross-sectional shape of the acoustic wave suppression unit 1031 may be a ring shape shown in FIG. 6c, for example, a circular ring shape or a square ring shape, and a plurality of acoustic wave suppression units 1031 may be sleeved together in sequence.

[0090] It should be noted that the acoustic filter 10 is usually manufactured on a substrate, and the cross-sectional shape of the acoustic wave suppression unit 1031 refers to a shape of a cross section of the acoustic wave suppression unit 1031 parallel to the substrate.

[0091] It should be understood that the cross-sectional shape of the acoustic wave suppression unit 1031 includes but is not limited to the diamond shape, the square shape, the oval shape, or the circular ring shape, or may be another regular or irregular shape. In addition, shapes of the plurality of acoustic wave suppression units 1031 may be the same, or may be different.

[0092] When the acoustic wave suppression unit group 103a includes a plurality of acoustic wave suppression units 1031, and the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are arranged in sequence in the first direction X at a same spacing h, that is, the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are periodically arranged in the first direction X, the spacing h at which the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are arranged in the first direction X may be adjusted to quickly and flexibly adjust the stopband generated by the acoustic wave suppression unit group 103a, so that the at least one stopband generated by the first acoustic wave suppression structure 103 can be used to reduce the acoustic wave that is leaked between the first resonator 101 and the second resonator 102 and that is propagated in the first direction X.

[0093] In some other examples, the acoustic wave suppression unit group 103a includes a plurality of acoustic wave suppression units 1031, and the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a may be arranged in sequence in the first direction X at spacings h that are not exactly the same, that is, the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group 103a are not periodically arranged in the first direction X.

[0094] Based on this, to ensure that the first acoustic wave suppression structure 103 can suppress, as far as possible, an acoustic wave that is leaked from the first resonator 101 and that is propagated in the first direction X, and ensure that the first acoustic wave suppression structure 103 can attenuate an acoustic wave leaked from the first resonator 101 in an oblique direction, as shown in FIG. 3a, a length L1 that is of the first acoustic wave suppression structure 103 and that is in a second direction Y is greater than a length L2 that is of the first resonator 101 and that is in the second direction Y, where the first direction X is perpendicular to the second direction Y. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a length L1 that is of the acoustic wave suppression unit 1031 and that is in the second direction Y is greater than the length L2 that is of the first resonator 101 and that is in the second direction Y. Similarly, to ensure that the first acoustic wave suppression structure 103 can suppress, as far as possible, an acoustic wave that is leaked from the second resonator 102 and that is propagated in the first direction X, and ensure that the first acoustic wave suppression structure 103 can attenuate an acoustic wave leaked from the second resonator 102 in the oblique direction, as shown in FIG. 3a, the length L1 that is of the first acoustic wave suppression structure 103 and that is in the second direction Y is greater than a length L3 that is of the second resonator 102 and that is in the second direction Y. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a length L1 that is of the acoustic wave suppression unit 1031 and that is in the second direction Y is greater than the length L3 that is of the second resonator 102 and that is in the second direction Y.

[0095] On the basis that the length L1 that is of the first acoustic wave suppression structure 103 and that is in the second direction Y is greater than the length L2 that is of the first resonator 101 and that is in the second direction Y, when the first acoustic wave suppression structure 103 is designed, in some examples, a projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X covers a projection that is of the first resonator 101 and that is in the first direction X, in other words, two boundaries that are of the first acoustic wave suppression structure 103 and that are in the second direction Y are outside a boundary that is of the first resonator 101 and that is in the second direction Y. When the acoustic wave suppression

unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a projection that is of the acoustic wave suppression unit 1031 and that is in the first direction X covers the projection that is of the first resonator 101 and that is in the first direction X, in other words, two boundaries that are of the acoustic wave suppression unit 1031 and that are in the second direction Y are outside the boundary that is of the first resonator 101 and that is in the second direction Y. This further ensures that the first acoustic wave suppression structure 103 can suppress the acoustic wave that is leaked from the first resonator 101 and that is propagated in the first direction X, and ensures that a part, of the projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X, outside the projection that is of the first resonator 101 and that is in the first direction X can attenuate the acoustic wave leaked from the first resonator 101 in the oblique direction. In some other examples, the projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X covers a part of the projection that is of the first resonator 101 and that is in the first direction X. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a projection that is of the acoustic wave suppression unit 1031 and that is in the first direction X covers a part of the projection that is of the first resonator 101 and that is in the first direction X.

[0096] Similarly, on the basis that the length L1 that is of the first acoustic wave suppression structure 103 and that is in the second direction Y is greater than the length L3 that is of the second resonator 102 and that is in the second direction Y, when the first acoustic wave suppression structure 103 is designed, in some examples, the projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X covers a projection that is of the second resonator 102 and that is in the first direction X, in other words, the two boundaries that are of the first acoustic wave suppression structure 103 and that are in the second direction Y are outside a boundary that is of the second resonator 102 and that is in the second direction Y. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a projection that is of the acoustic wave suppression unit 1031 and that is in the first direction X covers the projection that is of the second resonator 102 and that is in the first direction X, in other words, two boundaries that are of the acoustic wave suppression unit 1031 and that are in the second direction Y are outside the boundary that is of the second resonator 102 and that is in the second direction Y. This further ensures that the first acoustic wave suppression structure 103 can suppress the acoustic wave that is leaked from the second resonator 102 and that is propagated in the first direction X, and ensures that a part, of the projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X, outside the projection that is of the second resonator 102 and that is in the

first direction X can attenuate the acoustic wave leaked from the second resonator 102 in the oblique direction. In some other examples, the projection that is of the first acoustic wave suppression structure 103 and that is in the first direction X covers a part of the projection that is of the second resonator 102 and that is in the first direction X. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, a projection that is of the acoustic wave suppression unit 1031 and that is in the first direction X covers a part of the projection that is of the second resonator 102 and that is in the first direction X.

[0097] It may be understood that, in addition to the first resonator 101 and the second resonator 102, as shown in FIG. 7, the acoustic filter 10 may further include a third resonator 105. For a structure and a type of the third resonator 105, refer to the first resonator 101. Details are not described herein again. The second resonator 102 and the third resonator 105 are arranged in the second direction Y, where the first direction X is perpendicular to the second direction Y. In this case, in some examples, as shown in FIG. 7, the plurality of acoustic wave suppression units 1031 in the first acoustic wave suppression structure 103 include a plurality of first acoustic wave suppression units 1031a and a plurality of second acoustic wave suppression units 1031b. The first acoustic wave suppression unit 1031a is close to the first resonator 101, and the second acoustic wave suppression unit 1031b is close to the second resonator 102. The first acoustic wave suppression unit 1031a is configured to reduce an acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or configured to reduce an acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101. The first acoustic wave suppression unit 1031a is further configured to reduce an acoustic wave that is leaked from the first resonator 101 and that enters the third resonator 105, or reduce an acoustic wave that is leaked from the third resonator 105 and that enters the first resonator 101. The second acoustic wave suppression unit 1031b is configured to reduce an acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or configured to reduce an acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101.

[0098] "The plurality of acoustic wave suppression units 1031 in the first acoustic wave suppression structure 103" above refers to a plurality of acoustic wave suppression units 1031 in all acoustic wave suppression unit groups 103a.

[0099] It should be noted that the plurality of first acoustic wave suppression units 1031a may belong to one acoustic wave suppression unit group 103a, or may belong to a plurality of acoustic wave suppression unit groups 103a. Similarly, the plurality of second acoustic wave suppression units 1031b may belong to one acoustic wave suppression unit group 103a, or may belong to a plurality of acoustic wave suppression unit groups 103a.

[00100] Refer to FIG. 7. When the acoustic filter 10 includes the third resonator 105, and the second resonator 102 and the third resonator 105 are arranged in the second direction Y, there may be an acoustic wave leaked in the oblique direction in the first resonator 101, and the acoustic wave leaked in the oblique direction may affect the third resonator 105. Alternatively, there may be an acoustic wave leaked in the oblique direction in the third resonator 105, and the acoustic wave leaked in the oblique direction may affect the first resonator 101. However, in this embodiment of this application, the first acoustic wave suppression unit 1031a in the first acoustic wave suppression structure 103 not only can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, but also can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the third resonator 105, or reduce the acoustic wave that is leaked from the third resonator 105 and that enters the first resonator 101, so that the filtering performance of the acoustic filter 10 can be improved.

[00101] A structure of the first acoustic wave suppression unit 1031a is not limited in this embodiment of this application, provided that the first acoustic wave suppression unit 1031a not only can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, but also can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the third resonator 105, or reduce the acoustic wave that is leaked from the third resonator 105 and that enters the first resonator 101. In some examples, as shown in FIG. 7, the first acoustic wave suppression unit 1031a includes a first part 10311a and a second part 10312a, the second part 10312a is closer to the third resonator 105 than the first part 10311a, a first end of the second part 10312a is connected to a first end of the first part 10311a, and the first part 10311a and the second part 10312a are not parallel.

[00102] The first part 10311a is located between the first resonator 101 and the second resonator 102, and the first part 10311a may extend in the second direction Y, where the second direction Y is perpendicular to the first direction X.

[00103] It may be understood that the first part 10311a and the second part 10312a may be an integrated structure, in other words, the first part 10311a and the second part 10312a may be simultaneously manufactured through an integrated process. Alternatively, the first part 10311a and the second part 10312a may be two independent structures, in other words, the first part 10311a and the second part 10312a may be separately formed through two processes.

[00104] In addition, a material of the first part 10311a and a material of the second part 10312a may be the same, or may be different.

[00105] Based on this, when the acoustic filter 10 includes the third resonator 105, and the first

acoustic wave suppression unit 1031a includes the first part 10311a and the second part 10312a, for the second acoustic wave suppression unit 1031b, for example, as shown in FIG. 7, the second acoustic wave suppression unit 1031b may include only a part extending in the second direction Y. For another example, as shown in FIG. 8, the second acoustic wave suppression unit 1031b may include a third part 10311b and a fourth part 10312b, the fourth part 10312b is closer to the third resonator 105 than the third part 10311b, a first end of the fourth part 10312b is connected to a first end of the third part 10311b, and the third part 10311b and the fourth part 10312b are not parallel.

[00106] When the first acoustic wave suppression unit 1031a includes the first part 10311a and the second part 10312a, the first part 10311a may reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101. The second part 10312a or an intersection position of the first part 10311a and the second part 10312a may reduce the acoustic wave that is leaked from the first resonator 101 in the oblique direction and that enters the third resonator 105, or reduce an acoustic wave that is leaked from the third resonator 105 in the oblique direction and that enters the first resonator 101.

[00107] Herein, for example, an included angle α between the first part 10311a and the second part 10312a may range from 90° to 165°, and an opening of the included angle α between the first part 10311a and the second part 10312a faces the first resonator 101.

[00108] For example, the included angle α between the first part 10311a and the second part 10312a may be 90°, 100°, 105°, 130°, 145°, or 165°.

[00109] When the included angle α between the first part 10311a and the second part 10312a ranges from 90° to 165°, FIG. 8 shows that the included angle α between the first part 10311a and the second part 10312a is greater than 90°, and FIG. 9 shows that the included angle α between the first part 10311a and the second part 10312a is 90°.

[00110] When the included angle α between the first part 10311a and the second part 10312a ranges from 90° to 165°, the first acoustic wave suppression unit 1031a can more effectively reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, and reduce the acoustic wave that is leaked from the first resonator 101 in the oblique direction and that enters the third resonator 105, or reduce the acoustic wave that is leaked from the third resonator 105 in the oblique direction and that enters the first resonator 101.

[00111] To improve a suppression effect of the second part 10312a on the acoustic wave leaked from the first resonator 101 in the oblique direction, in some examples, the second part 10312a is

perpendicular to a propagation direction of the acoustic wave leaked from the first resonator 101 in the oblique direction.

[00112] It may be understood that, an acoustic wave propagated in the first direction X may be generated inside the first resonator 101. Therefore, in addition to the acoustic wave propagated in the first direction X, the first resonator 101 may further leak an acoustic wave propagated in an oblique direction W. When the acoustic wave suppression unit group 103a in the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, for example, a cross-sectional shape of the acoustic wave suppression unit 1031 is a rectangle shape. Refer to FIG. 10. A spacing h between two adjacent acoustic wave suppression units 1031 in the first direction X is different from a spacing p between two adjacent acoustic wave suppression units 1031 in the oblique direction W, where p is greater than h, and spacings (for example, h and p) between adjacent acoustic wave suppression units 1031 affect a stopband generated by the first acoustic wave suppression structure 103. Therefore, a stopband corresponding to a stopband effect of the plurality of acoustic wave suppression units 1031 in the first direction X is different from a stopband corresponding to a stopband effect of the plurality of acoustic wave suppression units 1031 in the oblique direction W. Frequency bands of the leaked acoustic wave are the same regardless of whether the acoustic wave leaked from the first resonator 101 is propagated in the first direction X or propagated in the oblique direction. In this case, when the first acoustic wave suppression structure 103 is designed, for the leaked acoustic wave propagated in the first direction X, an objective that a stopband generated by the first acoustic wave suppression structure 103 in the first direction X can be used to effectively reduce the acoustic wave that is leaked from the first resonator 101 and that is propagated in the first direction X can be achieved. However, stopbands generated by the plurality of acoustic wave suppression units 1031 in the first direction X are different from stopbands generated by the plurality of acoustic wave suppression units 1031 in the oblique direction W. Therefore, for the leaked acoustic wave propagated in the oblique direction W, a case in which a stopband generated by the first acoustic wave suppression structure 103 in the oblique direction W cannot be used to effectively reduce the acoustic wave that is leaked from the first resonator 101 and that is propagated in the oblique direction W exists. As a result, a suppression effect of the first acoustic wave suppression structure 103 in the oblique direction W is affected.

[00113] Based on this, considering that the frequency bands of the leaked acoustic waves are the same regardless of whether the acoustic waves leaked from the first resonator 101 is propagated in the first direction X or propagated in the oblique direction, when the first acoustic wave suppression unit 1031a includes the first part 10311a and the second part 10312a, a spacing h1 between adjacent first parts 10311a affects stopbands generated by a plurality of first parts 10311a,

and a spacing p1 between adjacent second parts 10312a affects stopbands generated by a plurality of second parts 10312a, to ensure that the first part 10311a can suppress the acoustic wave that is leaked from the first resonator 101 and that is propagated in the first direction X, and ensure that the second part 10312a can suppress the acoustic wave that is leaked from the first resonator 101 and that is propagated in the oblique direction, in some examples, as shown in FIG. 11, in a same acoustic wave suppression unit group 103a, a spacing h1 between adjacent first parts 10311a is equal to a spacing p1 between adjacent second parts 10312a.

[00114] In the same acoustic wave suppression unit group 103a, the spacing h1 between the adjacent first parts 10311a is equal to the spacing p1 between the adjacent second parts 10312a. Therefore, in the same acoustic wave suppression unit group 103a, stopbands generated by a plurality of first parts 10311a are the same as stopbands generated by a plurality of second parts 10312a. In this case, acoustic waves that are of a same frequency band and that are leaked from the first resonator 101 can be suppressed by the plurality of first parts 10311a when leaked in the first direction X, and can be suppressed by the plurality of second parts 10312a when leaked in the oblique direction, so that it is ensured that stopband effects are basically the same in all directions, and a suppression effect of the first acoustic wave suppression unit 1031a is improved.

[00115] In some other examples, in a same acoustic wave suppression unit group 103a, a spacing h1 between adjacent first parts 10311a is not equal to a spacing p1 between adjacent second parts 10312a.

[00116] In this embodiment of this application, for the first acoustic wave suppression unit 1031a, when the first acoustic wave suppression unit 1031a includes the first part 10311a and the second part 10312a, in some examples, as shown in FIG. 8, a projection that is of the first end M (namely, an end connected to the first end of the second part 10312a in the first part 10311a) of the first part 10311a and that is in the first direction X is inside the first resonator 101. In some other examples, as shown in FIG. 12, in the first direction X, the first end M of the first part 10311a is flush with the first resonator 101, or a projection that is of the first end M of the first part 10311a and that is in the first direction X is outside the first resonator 101.

[00117] It may be understood that, in the first acoustic wave suppression unit 1031a, the first part 10311a is mainly configured to suppress the acoustic wave that is leaked from the first resonator 101 and that is propagated in the first direction X, and the second part 10312a is mainly configured to suppress the acoustic wave that is leaked from the first resonator 101 and that is propagated in the oblique direction W. Therefore, when the first end M of the first part 10311a is flush with the first resonator 101 in the first direction X, or the projection that is of the first end M of the first part 10311a and that is in the first direction X is outside the first resonator 101, it can be ensured that all acoustic waves that are leaked from the first resonator 101 and that are

propagated in the first direction X can be suppressed by the first part 10311a.

[00118] Based on this, for the first acoustic wave suppression unit 1031a, when the first acoustic wave suppression unit 1031a includes the first part 10311a and the second part 10312a, in some examples, as shown in FIG. 13a, the second part 10312a and the first part 10311a are directly connected together.

[00119] In some other examples, as shown in FIG. 13b, the second part 10312a and the first part 10311a are connected together by using another mechanical part. For example, the first acoustic wave suppression unit 1031a further includes a first connection part 10313a, the first connection part 10313a is disposed between the first part 10311a and the second part 10312a, one end of the first connection part 10313a is connected to the first end of the first part 10311a, and the other end of the first connection part 10313a is connected to the first end of the second part 10312a.

[00120] In this embodiment of this application, an included angle between the first part 10311a and the first connection part 10313a is different from an included angle between the second part 10312a and the first connection part 10313a.

[00121] Herein, the first connection part 10313a and the first part 10311a and the second part 10312a may be an integrated structure, in other words, the first part 10311a, the second part 10312a, and the first connection part 10313a may be simultaneously manufactured through an integrated process. Alternatively, the first connection part 10313a, the first part 10311a, and the second part 10312a may be three independent structures, in other words, the first connection part 10313a, the first part 10311a, and the second part 10312a may be separately formed through a plurality of processes.

[00122] In addition, a material of the first connection part 10313a, a material of the first part 10311a, and a material of the second part 10312a may be the same, or may be different.

[00123] It should be understood that the second part 10312a and the first part 10311a may be connected together by using one first connection part 10313a, but this is not limited. For example, the second part 10312a and the first part 10311a may be connected by using a plurality of first connection parts 10313a that are connected together in sequence, and included angles between the plurality of first connection parts 10313a and the first part 10311a may be different.

[00124] When the first acoustic wave suppression unit 1031a further includes the first connection part 10313a, the first connection part 10313a is disposed between the first part 10311a and the second part 10312a, and the first part 10311a and the second part 10312a are connected together by using the first connection part 10313a, a problem that is caused by a sharp angle due to a direct connection between the first part 10311a and the second part 10312a and that affects the filtering performance of the acoustic filter 10 can be avoided. In addition, process difficulty in

manufacturing the first acoustic wave suppression unit 1031a can be reduced.

[00125] When the acoustic filter 10 further includes the third resonator 105, the second resonator 102 and the third resonator 105 are arranged in the second direction Y, and an acoustic wave propagated in the second direction Y may be generated inside the second resonator 102, and/or an acoustic wave propagated in the second direction Y may be generated inside the third resonator 105, to reduce an acoustic wave that is leaked from the second resonator 102 and propagated in the second direction Y and that enters the third resonator 105 or prevent the acoustic wave that is leaked from the second resonator 102 and propagated in the second direction Y from entering the third resonator 105, or reduce an acoustic wave that is leaked from the third resonator 105 and propagated in the second direction Y and that enters the second resonator 102 or prevent the acoustic wave that is leaked from the third resonator 105 and propagated in the second direction Y from entering the second resonator 102, in some examples, as shown in FIG. 14, the acoustic filter 10 may further include a second acoustic wave suppression structure 106. The second acoustic wave suppression structure 106 is disposed between the second resonator 102 and the third resonator 105, and at least one stopband generated by the second acoustic wave suppression structure 106 is used to reduce an acoustic wave that is leaked between the second resonator 102 and the third resonator 105 and that is propagated in the second direction Y.

[00126] It may be understood that, when the second acoustic wave suppression structure 106 is designed, the specific frequency band of the acoustic filter 10 may be covered by using the at least one stopband generated by the second acoustic wave suppression structure 106, to achieve an objective of reducing, by using the at least one stopband generated by the second acoustic wave suppression structure 106, the acoustic wave that is leaked between the second resonator 102 and the third resonator 105 and that is propagated in the second direction Y, that is, reducing a spur caused by the acoustic wave that is leaked between the second resonator 102 and the third resonator 105 and that is propagated in the second direction Y, so as to reduce the acoustic wave that is leaked from the second resonator 102 and propagated in the second direction Y and that enters the third resonator 105 or prevent the acoustic wave that is leaked from the second resonator 102 and propagated in the second direction Y from entering the third resonator 105, or reduce the acoustic wave that is leaked from the third resonator 105 and propagated in the second direction Y and that enters the second resonator 102 or prevent the acoustic wave that is leaked from the third resonator 105 and that is propagated in the second direction Y from entering the second resonator 102, so that the filtering performance of the acoustic filter 10 is improved.

[00127] A specific structure of the second acoustic wave suppression structure 106 is not limited in this embodiment of this application, provided that the at least one stopband generated by the second acoustic wave suppression structure 106 can be used to reduce the acoustic wave that is

leaked between the second resonator 102 and the third resonator 105 and that is propagated in the second direction Y.

[00128] Herein, for the structure of the second acoustic wave suppression structure 106, refer to the structure of the first acoustic wave suppression structure 103. For example, the second acoustic wave suppression structure 106 may include at least one acoustic wave suppression unit group, and each acoustic wave suppression unit group includes a plurality of acoustic wave suppression units 1031. The plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group are arranged in sequence in the second direction Y at a same spacing, that is, the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group are periodically arranged in the second direction Y.

[00129] It may be understood that a periodicity of the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group of the first acoustic wave suppression structure 103 and a periodicity of the plurality of acoustic wave suppression units 1031 in the acoustic wave suppression unit group of the second acoustic wave suppression structure 106 may be the same, or may be different.

[00130] When the acoustic wave suppression unit group of the second acoustic wave suppression structure 106 includes a plurality of acoustic wave suppression units 1031, for a design, a shape, a material, and the like of a structure of the acoustic wave suppression unit 1031 in the acoustic wave suppression unit group of the second acoustic wave suppression structure 106, refer to the acoustic wave suppression unit 1031 in the acoustic wave suppression unit group of the first acoustic wave suppression structure 103. Details are not described herein again.

[00131] In addition, the first acoustic wave suppression structure 103 and the second acoustic wave suppression structure 106 may be connected together, or may not be connected to each other. When the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, and the second acoustic wave suppression structure 106 includes a plurality of acoustic wave suppression units 1031, the plurality of acoustic wave suppression units 1031 in the first acoustic wave suppression structure 103 and the plurality of acoustic wave suppression units 1031 in the second acoustic wave suppression structure 106 may be connected together in one-to-one correspondence, or may not be connected.

[00132] Based on the foregoing descriptions, in some examples, as shown in FIG. 15, the acoustic filter 10 further includes a fourth resonator 107, and the first resonator 101 and the fourth resonator 107 are arranged in the second direction Y. The second acoustic wave suppression unit 1031b is configured to reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101. In addition, the second acoustic wave

suppression unit 1031b may be further configured to reduce an acoustic wave that is leaked from the second resonator 102 and that enters the fourth resonator 107, or reduce an acoustic wave that is leaked from the fourth resonator 107 and that enters the second resonator 102.

[00133] Herein, for a structure of the fourth resonator 107, refer to the foregoing structures of the first resonator 101 and the second resonator 102. Details are not described herein again.

[00134] Refer to FIG. 15. When the acoustic filter 10 further includes the fourth resonator 107, and the first resonator 101 and the fourth resonator 107 are arranged in the second direction Y, there may be an acoustic wave leaked in the oblique direction in the second resonator 102, and the acoustic wave leaked in the oblique direction may affect the fourth resonator 107. Alternatively, there may be an acoustic wave leaked in the fourth resonator 107 in the oblique direction, and the acoustic wave leaked in the oblique direction may affect the second resonator 102. However, in this embodiment of this application, the second acoustic wave suppression unit 1031b not only can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, but also can reduce the acoustic wave that is leaked from the second resonator 102 and that enters the fourth resonator 107, or reduce the acoustic wave that is leaked from the fourth resonator 107 and that enters the second resonator 102, so that the filtering performance of the acoustic filter 10 can be improved.

[00135] A structure of the second acoustic wave suppression unit 1031b is not limited in this embodiment of this application, provided that the second acoustic wave suppression unit 1031b not only can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, but also can reduce the acoustic wave that is leaked from the second resonator 102 and that enters the fourth resonator 107, or reduce the acoustic wave that is leaked from the fourth resonator 107 and that enters the second resonator 102. In some examples, as shown in FIG. 15, the second acoustic wave suppression unit 1031b includes a third part 10311b and a fourth part 10312b, the fourth part 10312b is closer to the fourth resonator 107 than the third part 10311b, a first end of the fourth part 10312b is connected to a first end of the third part 10311b, and the third part 10311b and the fourth part 10312b are not parallel.

[00136] The third part 10311b is located between the first resonator 101 and the second resonator 102, and the third part 10311b may extend in the second direction Y, where the second direction Y is perpendicular to the first direction X.

[00137] It should be noted that, for designs of the third part 10311b and the fourth part 10312b in the second acoustic wave suppression unit 1031b, refer to the foregoing designs of the first part 10311a and the second part 10312a in the first acoustic wave suppression unit 1031a.

[00138] When the second acoustic wave suppression unit 1031b includes the third part 10311b and the fourth part 10312b, the third part 10311b can reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101. The fourth part 10312b or an intersection position of the third part 10311b and the fourth part 10312b can reduce the acoustic wave that is leaked from the second resonator 102 and that enters the fourth resonator 107, or reduce the acoustic wave that is leaked from the fourth resonator 107 and that enters the second resonator 102.

[00139] Herein, the third part 10311b and the fourth part 10312b may be an integrated structure, or the third part 10311b and the fourth part 10312b may be two independent structures.

[00140] In addition, a material of the third part 10311b and a material of the fourth part 10312b may be the same, or may be different.

[00141] In addition, for example, an included angle β between the third part 10311b and the fourth part 10312b may range from 90° to 165°, and an opening of the included angle β between the third part 10311b and the fourth part 10312b faces the second resonator 102.

[00142] For example, the included angle β between the third part 10311b and the fourth part 10312b may be 90°, 100°, 105°, 130°, 145°, or 165°.

[00143] When the included angle β between the third part 10311b and the fourth part 10312b ranges from 90° to 165°, the second acoustic wave suppression unit 1031b can more effectively reduce the acoustic wave that is leaked from the first resonator 101 and that enters the second resonator 102, or reduce the acoustic wave that is leaked from the second resonator 102 and that enters the first resonator 101, and reduce the acoustic wave that is leaked from the second resonator 102 and that enters the fourth resonator 107, or reduce the acoustic wave that is leaked from the fourth resonator 107 and that enters the second resonator 102.

[00144] It should be noted that the included angle α between the second part 10312a and the first part 10311a and the included angle β between the fourth part 10312b and the third part 10311b may be the same, or may be different.

[00145] To improve a suppression effect of the fourth part 10312b on the acoustic wave leaked from the second resonator 102 in the oblique direction, in some examples, the fourth part 10312b is perpendicular to a propagation direction of the acoustic wave leaked from the second resonator 102 in the oblique direction.

[00146] In some examples, as shown in FIG. 11, in a same acoustic wave suppression unit group 103a, a spacing h2 between adjacent third parts 10311b is equal to a spacing p2 between adjacent fourth parts 10312b.

[00147] In the same acoustic wave suppression unit group 103a, the spacing h2 between the

adjacent third parts 10311b is equal to the spacing p2 between the adjacent fourth parts 10312b. Therefore, in the same acoustic wave suppression unit group 103a, stopbands generated by a plurality of third parts 10311b are the same as stopbands generated by a plurality of fourth parts 10312b. In this case, acoustic waves that are of a same frequency band and that are leaked from the second resonator 102 can be suppressed by the plurality of third parts 10311b when leaked in the first direction X, and can be suppressed by the plurality of fourth parts 10312b when leaked in the oblique direction, so that it is ensured that stopband effects are basically the same in all directions, and a suppression effect of the second acoustic wave suppression unit 1031b is further improved.

[00148] In some other examples, in a same acoustic wave suppression unit group 103a, a spacing h2 between adjacent third parts 10311b is not equal to a spacing p2 between adjacent fourth parts 10312b.

[00149] In this embodiment of this application, for the second acoustic wave suppression unit 1031b, when the second acoustic wave suppression unit 1031b includes the third part 10311b and the fourth part 10312b, in some examples, as shown in FIG. 8, a projection that is of the first end N of the third part 10311b (namely, an end connected to the first end of the fourth part 10312b in the third part 10311b) and that is in the first direction X is inside the second resonator 102. In some other examples, as shown in FIG. 15, in the first direction X, the first end N of the third part 10311b is flush with the second resonator 102, or a projection that is of the first end N of the third part 10311b and that is in the first direction X is outside the second resonator 102.

[00150] It may be understood that, in the second acoustic wave suppression unit 1031b, the third part 10311b is mainly configured to suppress an acoustic wave that is leaked from the second resonator 102 and that is propagated in the first direction X, and the fourth part 10312b is mainly configured to suppress an acoustic wave that is leaked from the second resonator 102 and that is propagated in the oblique direction W. Therefore, when the first end N of the third part 10311b is flush with the second resonator 102 in the first direction X, or the projection that is of the first end N of the third part 10311b and that is in the first direction X is outside the second resonator 102, it can be ensured that all acoustic waves that are leaked from the second resonator 102 and that are propagated in the first direction X can be suppressed by the third part 10311b.

[00151] Based on this, for the second acoustic wave suppression unit 1031b, when the second acoustic wave suppression unit 1031b includes the third part 10311b and the fourth part 10312b, in some examples, as shown in FIG. 13a, the third part 10311b and the fourth part 10312b are directly connected together.

[00152] In some other examples, as shown in FIG. 13b, the third part 10311b and the fourth part 10312b are connected together by using another mechanical part. For example, the second

acoustic wave suppression unit 1031b further includes a second connection part 10313b, the second connection part 10313b is disposed between the third part 10311b and the fourth part 10312b, one end of the second connection part 10313b is connected to the first end of the third part 10311b, and the other end of the second connection part 10313b is connected to the first end of the fourth part 10312b.

[00153] In this embodiment of this application, an included angle between the third part 10311b and the second connection part 10313b is different from an included angle between the fourth part 10312b and the second connection part 10313b.

[00154] In addition, for the second connection part 10313b, refer to the foregoing first connection part 10313a. Details are not described herein again.

[00155] It should be understood that the third part 10311b and the fourth part 10312b may be connected together by using one second connection part 10313b, but this is not limited. For example, the third part 10311b and the fourth part 10312b may be connected by using a plurality of second connection parts 10313b that are connected together in sequence, and included angles between the plurality of second connection parts 10313b and the third part 10311b may be different.

[00156] When the second acoustic wave suppression unit 1031b further includes the second connection part 10313b, the second connection part 10313b is disposed between the third part 10311b and the fourth part 10312b, and the third part 10311b and the fourth part 10312b are connected together by using the second connection part 10313b, a problem that is caused by a sharp angle due to a direct connection between the third part 10311b and the fourth part 10312b and that affects the filtering performance of the acoustic filter 10 can be avoided. In addition, process difficulty in manufacturing the second acoustic wave suppression unit 1031b can be reduced.

[00157] In some examples, the plurality of first acoustic wave suppression units 1031a and the plurality of second acoustic wave suppression units 1031b in the first acoustic wave suppression structure 103 are symmetrically disposed with respect to an axis of symmetry extending in the second direction Y.

[00158] When the plurality of first acoustic wave suppression units 1031a and the plurality of second acoustic wave suppression units 1031b in the first acoustic wave suppression structure 103 are symmetrically disposed with respect to the axis of symmetry extending in the second direction Y, it can be ensured that a suppression effect of the first acoustic wave suppression structure 103 on an acoustic wave leaked from the first resonator 101 is the same as a suppression effect of the first acoustic wave suppression structure 103 on an acoustic wave leaked from the second resonator 102, so that uniformity of the filtering performance of the acoustic filter 10 can be improved.

[00159] When the acoustic filter 10 includes the third resonator 105 and the fourth resonator

107, and an acoustic wave propagated in the first direction X may be generated inside the third resonator 105, and/or an acoustic wave propagated in the first direction X may be generated inside the fourth resonator 107, in some examples, as shown in FIG. 15, the acoustic filter 10 further includes a third acoustic wave suppression structure 108, the third acoustic wave suppression structure 108 is disposed between the third resonator 105 and the fourth resonator 107, and at least one stopband generated by the third acoustic wave suppression structure 108 is used to reduce an acoustic wave that is leaked between the third resonator 105 and the fourth resonator 107 and that is propagated in the first direction X, that is, reduce a spur caused by the acoustic wave that is leaked between the third resonator 105 and the fourth resonator 107 and that is propagated in the first direction X.

[00160] In this embodiment of this application, to avoid a case in which an acoustic wave leaked from the third resonator 105 enters the fourth resonator 107, or an acoustic wave leaked from the fourth resonator 107 enters the third resonator 105, the acoustic filter 10 provided in embodiments of this application further includes the third acoustic wave suppression structure 108 disposed between the third resonator 105 and the fourth resonator 107, and the at least one stopband generated by the third acoustic wave suppression structure 108 is used to reduce the acoustic wave that is leaked between the third resonator 105 and the fourth resonator 107 and that is propagated in the first direction X, that is, reduce the spur caused by the acoustic wave that is leaked between the third resonator 105 and the fourth resonator 107 and that is propagated in the first direction X, in other words, the at least one stopband generated by the third acoustic wave suppression structure 108 may be used to attenuate acoustic waves that are of the specific frequency band of the acoustic filter 10 and that are leaked from the third resonator 105 and the fourth resonator 107. In this case, the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the third resonator 105 can be suppressed from entering the fourth resonator 107, or the acoustic wave that is of the specific frequency band of the acoustic filter 10 and that is leaked from the fourth resonator 107 can be suppressed from entering the third resonator 105, so that the filtering performance of the acoustic filter 10 is ensured.

[00161] It should be noted that, for a structure of the third acoustic wave suppression structure 108, refer to the foregoing structure of the first acoustic wave suppression structure 103. Details are not described herein again. For example, the third acoustic wave suppression structure 108 may include a plurality of acoustic wave suppression units 1031, and the plurality of acoustic wave suppression units 1031 are arranged in sequence in the first direction X at a same spacing, that is, the plurality of acoustic wave suppression units 1031 are periodically arranged in the first direction X.

[00162] The plurality of acoustic wave suppression units 1031 in the third acoustic wave

suppression structure 108, which is similar to the first acoustic wave suppression structure 103, may also include a plurality of first acoustic wave suppression units 1031a and a plurality of second acoustic wave suppression units 1031b. The first acoustic wave suppression unit 1031a is close to the third resonator 105, and the second acoustic wave suppression unit 1031b is close to the fourth resonator 107. For structures of the first acoustic wave suppression unit 1031a and the second acoustic wave suppression unit 1031b, refer to the foregoing descriptions. Details are not described herein again. It should be noted that, when the first acoustic wave suppression unit 1031a in the third acoustic wave suppression structure 108 includes a first part 10311a and a second part 10312a, the first part 10311a is closer to the third resonator 105 than the second part 10312a. When the second acoustic wave suppression unit 1031b in the third acoustic wave suppression structure 108 includes a third part 10311b and a fourth part 10312b, the third part 10311b is closer to the fourth resonator 107 than the fourth part 10312b.

[00163] When the acoustic filter 10 further includes the fourth resonator 107, the first resonator 101 and the fourth resonator 107 are arranged in the second direction Y, and an acoustic wave propagated in the second direction Y may be generated inside the first resonator 101, and/or an acoustic wave propagated in the second direction Y may be generated inside the fourth resonator 107, to reduce an acoustic wave that is leaked from the first resonator 101 and propagated in the second direction Y and that enters the fourth resonator 107 or prevent the acoustic wave that is leaked from the first resonator 101 and propagated in the second direction Y from entering the fourth resonator 107, or reduce an acoustic wave that is leaked from the fourth resonator 107 and propagated in the second direction Y and that enters the first resonator 101 or prevent the acoustic wave that is leaked from the fourth resonator 107 and propagated in the second direction Y from entering the first resonator 101, in some examples, as shown in FIG. 16, the acoustic filter 10 further includes a fourth acoustic wave suppression structure 109. The fourth acoustic wave suppression structure 109 is disposed between the first resonator 101 and the fourth resonator 107, and at least one stopband generated by the fourth acoustic wave suppression structure 109 is used to reduce an acoustic wave that is leaked between the first resonator 101 and the fourth resonator 107 and that is propagated in a second direction Y, that is, reduce a spur caused by the acoustic wave that is leaked between the first resonator 101 and the fourth resonator 107 and that is propagated in the second direction Y.

[00164] It may be understood that, when the fourth acoustic wave suppression structure 109 is designed, the specific frequency band of the acoustic filter 10 may be covered by using the at least one stopband generated by the fourth acoustic wave suppression structure 109, to achieve an objective of reducing, by using the at least one stopband generated by the fourth acoustic wave suppression structure 109, the acoustic wave that is leaked between the first resonator 101 and the

fourth resonator 107 and that is propagated in the second direction Y, so as to reduce an acoustic wave that is leaked from the first resonator 101 and propagated in the second direction Y and that enters the fourth resonator 107 or prevent the acoustic wave that is leaked from the first resonator 101 and that is propagated in the second direction Y from entering the fourth resonator 107, or reduce an acoustic wave that is leaked from the fourth resonator 107 and propagated in the second direction Y and that enters the first resonator 101 or prevent the acoustic wave that is leaked from the fourth resonator 107 and that is propagated in the second direction Y from entering the first resonator 101, so that the filtering performance of the acoustic filter 10 is improved.

[00165] A specific structure of the fourth acoustic wave suppression structure 109 is not limited in this embodiment of this application, provided that the at least one stopband generated by the fourth acoustic wave suppression structure 109 can be used to reduce the acoustic wave that is leaked between the first resonator 101 and the fourth resonator 107 and that is propagated in the second direction Y.

[00166] Herein, for the structure of the fourth acoustic wave suppression structure 109, refer to the foregoing structure of the second acoustic wave suppression structure 106. Details are not described herein again.

[00167] Herein, the fourth acoustic wave suppression structure 109 and the first acoustic wave suppression structure 103 may be connected together, or may not be connected to each other. When the first acoustic wave suppression structure 103 includes a plurality of acoustic wave suppression units 1031, and the fourth acoustic wave suppression structure 109 includes a plurality of acoustic wave suppression units 1031, the plurality of acoustic wave suppression units 1031 in the first acoustic wave suppression structure 103 and the plurality of acoustic wave suppression units 1031 in the fourth acoustic wave suppression structure 109 may be connected together in one-to-one correspondence, or may not be connected. Similarly, the fourth acoustic wave suppression structure 109 and the third acoustic wave suppression structure 108 may be connected together, or may not be connected to each other. When the third acoustic wave suppression structure 108 includes a plurality of acoustic wave suppression units 1031, and the fourth acoustic wave suppression structure 109 includes a plurality of acoustic wave suppression units 1031, the plurality of acoustic wave suppression units 1031 in the third acoustic wave suppression structure 108 and the plurality of acoustic wave suppression units 1031 in the fourth acoustic wave suppression structure 109 may be connected together in one-to-one correspondence, or may not be connected.

[00168] Based on the foregoing descriptions, it may be understood that, when the acoustic filter 10 further includes a fifth resonator, and the fifth resonator is disposed between the first resonator 101 and the fourth resonator 107, a structural design of the first acoustic wave suppression

structure 103 is similar to a structural design when the acoustic filter 10 includes the fourth resonator 107. Refer to the foregoing structural design of the first acoustic wave suppression structure 103 when the acoustic filter 10 includes the fourth resonator 107. Details are not described herein again. Similarly, when the acoustic filter 10 further includes a sixth resonator, and the sixth resonator is disposed between the second resonator 102 and the third resonator 105, a structural design of the first acoustic wave suppression structure 103 is similar to a structural design when the acoustic filter 10 includes the third resonator 105. Refer to the foregoing structural design of the first acoustic wave suppression structure 103 when the acoustic filter 10 includes the third resonator 105. Details are not described herein again.

[00169] The foregoing descriptions are merely specific implementations of this application. However, the protection scope of this application is not limited thereto. Any change or replacement readily figured out by a person skilled in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

CLAIMS

1. An acoustic filter, comprising:

a first resonator;

a second resonator, wherein the first resonator and the second resonator are arranged in a first direction; and

a first acoustic wave suppression structure, disposed between the first resonator and the second resonator, wherein at least one stopband generated by the first acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the first resonator and the second resonator and that is propagated in the first direction.

2. The acoustic filter according to claim 1, wherein the first acoustic wave suppression structure comprises at least one acoustic wave suppression unit group, each first acoustic wave suppression unit group in the at least one acoustic wave suppression unit group comprises a plurality of acoustic wave suppression units, and the plurality of acoustic wave suppression units in the first acoustic wave suppression unit group are periodically arranged in the first direction.

3. The acoustic filter according to claim 2, wherein the at least one acoustic wave suppression unit group comprises a plurality of acoustic wave suppression unit groups; and

spacings between two adjacent acoustic wave suppression units in different acoustic wave suppression unit groups are different.

4. The acoustic filter according to any one of claims 1 to 3, wherein a length that is of the first acoustic wave suppression structure and that is in a second direction is greater than a length that is of the first resonator and that is in the second direction; and/or

a length that is of the first acoustic wave suppression structure and that is in a second direction is greater than a length that is of the second resonator and that is in the second direction, wherein

the first direction is perpendicular to the second direction.

5. The acoustic filter according to claim 4, wherein a projection that is of the first acoustic wave suppression structure and that is in the first direction covers a projection that is of the first resonator and that is in the first direction; and/or

a projection that is of the first acoustic wave suppression structure and that is in the first direction covers a projection that is of the second resonator and that is in the first direction.

6. The acoustic filter according to claim 2 or 3, wherein the acoustic filter further comprises a third resonator, the second resonator and the third resonator are arranged in the second direction, and the first direction is perpendicular to the second direction;

the plurality of acoustic wave suppression units in the first acoustic wave suppression structure comprise a plurality of first acoustic wave suppression units and a plurality of second

acoustic wave suppression units, the first acoustic wave suppression unit is close to the first resonator, and the second acoustic wave suppression unit is close to the second resonator;

both the first acoustic wave suppression unit and the second acoustic wave suppression unit are configured to reduce an acoustic wave that is leaked from the first resonator and that enters the second resonator, or reduce an acoustic wave that is leaked from the second resonator and that enters the first resonator; and

the first acoustic wave suppression unit is further configured to reduce an acoustic wave that is leaked from the first resonator and that enters the third resonator, or reduce an acoustic wave that is leaked from the third resonator and that enters the first resonator.

7. The acoustic filter according to claim 6, wherein the first acoustic wave suppression unit comprises a first part and a second part, the second part is closer to the third resonator than the first part, a first end of the second part is connected to a first end of the first part, and the first part and the second part are not parallel.

8. The acoustic filter according to claim 7, wherein an included angle between the first part and the second part ranges from 90° to 165°, and an opening of the included angle between the first part and the second part faces the first resonator.

9. The acoustic filter according to claim 7 or 8, wherein in a same acoustic wave suppression unit group, a spacing between adjacent first parts is equal to a spacing between adjacent second parts.

10. The acoustic filter according to any one of claims 7 to 9, wherein in the first direction, the first end of the first part is flush with the first resonator, or a projection that is of the first end of the first part and that is in the first direction is outside the first resonator.

11. The acoustic filter according to any one of claims 7 to 10, wherein the first acoustic wave suppression unit further comprises a first connection part, the first connection part is disposed between the first part and the second part, one end of the first connection part is connected to the first end of the first part, and the other end is connected to the first end of the second part.

12. The acoustic filter according to any one of claims 6 to 11, wherein the acoustic filter further comprises a second acoustic wave suppression structure, the second acoustic wave suppression structure is disposed between the second resonator and the third resonator, and at least one stopband generated by the second acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the second resonator and the third resonator and that is propagated in the second direction.

13. The acoustic filter according to any one of claims 6 to 12, wherein the acoustic filter further comprises a fourth resonator, and the first resonator and the fourth resonator are arranged in the second direction; and

the second acoustic wave suppression unit is further configured to reduce an acoustic wave that is leaked from the second resonator and that enters the fourth resonator, or reduce an acoustic wave that is leaked from the fourth resonator and that enters the second resonator.

14. The acoustic filter according to claim 13, wherein the second acoustic wave suppression unit comprises a third part and a fourth part, the fourth part is closer to the fourth resonator than the third part, a first end of the fourth part is connected to a first end of the third part, and the third part and the fourth part are not parallel.

15. The acoustic filter according to any one of claims 6 to 14, wherein the plurality of first acoustic wave suppression units and the plurality of second acoustic wave suppression units are symmetrically disposed with respect to an axis of symmetry extending in the second direction.

16. The acoustic filter according to claim 13 or 14, wherein the acoustic filter further comprises a third acoustic wave suppression structure, the third acoustic wave suppression structure is disposed between the third resonator and the fourth resonator, and at least one stopband generated by the third acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the third resonator and the fourth resonator and that is propagated in the first direction.

17. The acoustic filter according to claim 13 or 14, wherein the acoustic filter further comprises a fourth acoustic wave suppression structure, the fourth acoustic wave suppression structure is disposed between the first resonator and the fourth resonator, and at least one stopband generated by the fourth acoustic wave suppression structure is used to reduce an acoustic wave that is leaked between the first resonator and the fourth resonator and that is propagated in the second direction.

18. The acoustic filter according to any one of claims 1 to 17, wherein the first resonator is a surface acoustic wave resonator, and/or the second resonator is a surface acoustic wave resonator; and

the surface acoustic wave resonator comprises an interdigital transducer; the interdigital transducer comprises a first busbar and a second busbar that are disposed opposite to each other, a plurality of first electrode fingers that are arranged in sequence in the first direction and that are in contact with the first busbar, and a plurality of second electrode fingers that are arranged in sequence in the first direction and that are in contact with the second busbar; and the first electrode finger and the second electrode finger are alternately arranged in sequence in the first direction.

19. The acoustic filter according to any one of claims 1 to 17, wherein the first resonator is a bulk acoustic wave resonator, and/or the second resonator is a bulk acoustic wave resonator.

20. An electronic device, comprising an acoustic filter, a processor, and a printed circuit board, wherein both the acoustic filter and the processor are disposed on the printed circuit board, and

the acoustic filter is the acoustic filter according to any one of claims 1 to 19.