cycle environment, each of the electronic components and the printed circuit board repeats thermal expansion and contraction. Due to this repetition, a certain degree of thermal displacement occurs at soldered portions (hereinafter, referred to as "solder joints") that join the electronic components and the printed circuit board. Therefore, in a heat-cycle environment, stress is continuously applied to the solder joints, and eventually causes breakage of the solder joints.

[0005] Even when the solder joints are not completely broken, their partial breakage may increase the resistance value of the electronic circuit and cause erroneous operation. Erroneous operation of the ECU installed in an automobile may lead to a serious accident. Therefore, in order to avoid erroneous operation of the ECU, improvement in heat cycle resistance is particularly important.

[0006] Therefore, for example, in Patent Document 1, as a solder alloy with high heat cycle resistance, an Sn-Ag-Cu-Bi-Sb-Co-Fe solder alloy is disclosed. This solder alloy is excellent not only in heat cycle resistance but also in acoustic quality.

Citation List

Patent Document

[0007] Patent Document 1: Japanese Patent Publication No. 6889387

Summary

[0007a] In an aspect of the present disclosure, there is provided a solder alloy having an alloy composition consisting of, by mass%,

Ag: 3.0 to 3.8%,

Cu: 0.1 to 1.0%,

Bi: more than 0% and 0.9% or less,

Sb: 1.0 to 7.9%,

Fe: 0.020 to 0.040%,

Co: 0.001% to 0.020%, with the balance being Sn.

[0007b] In another aspect of the present disclosure, there is provided a solder paste comprising a solder powder consisting of the solder alloy as disclosed herein.

[0007c] In a further aspect of the present disclosure, there is provided a solder ball consisting of the solder alloy as disclosed herein.

[0007d] In another aspect of the present disclosure, there is provided a solder preform consisting of the solder alloy as disclosed herein.

[0007e] In a further aspect of the present disclosure, there is provided a solder joint consisting of the solder alloy as disclosed herein.

[0007f] In another aspect of the present disclosure, there is provided a vehicle-mounted electronic circuit comprising the solder alloy as disclosed herein.

[0007g] In a further aspect of the present disclosure, there is provided an ECU electronic circuit comprising the solder alloy as disclosed herein.

[0007h] In another aspect of the present disclosure, there is provided a vehicle-mounted electronic circuit device comprising the vehicle-mounted electronic circuit as disclosed herein.

[0007i] In a further aspect of the present disclosure, there is provided an ECU electronic circuit device comprising the ECU electronic circuit as disclosed herein.

Technical Problem

[0008] In Patent Document 1, an alloy composition not containing Ni so as to prevent compounds that precipitate at a joint interface from being liberated in the solder alloy is disclosed. Here, the heat cycle resistance of the solder alloy described in Patent Document 1 was evaluated through a heat cycle test in which a heat cycle from -55°C to 150°C was repeated 3000 times. However, the heat conductivity required as a solder joint must not deteriorate in accordance with excessive specifications of the heat cycle resistance.

[0009] In recent years, electronic components have been increasingly downsized, and a large current is supplied according to improvement in performance. From the viewpoint of preventing erroneous operation of electronic components, heat radiation of electronic components is a big problem for electronic circuits. Heat radiation means of electronic components are attachment of a heatsink, etc. However, when the heat conductivity of the solder joint is improved, heat radiation of electronic circuits without installation of a large heatsink can be expected. Downsizing of the heatsink improves, for example, the degree of