CLAIMS

What is claimed is:

1. A switching device having a plurality of input-output terminals and a common terminal that are to be connected to external devices, the switching device comprising:

a switch connected to the plurality of input-output terminals and the common terminal, the switch selecting one of the plurality of input-output terminals and connecting said selected one of the plurality of input-output terminals to the common terminal; and

a delay line that is connected in parallel to the switch between two input-output terminals among the plurality of input-output terminals, the delay line comprising:

a first IDT that is formed on a piezoelectric layer and that converts a first electrical signal input from one of the two input-output terminals into an acoustic wave propagating through the piezoelectric layer; and

a second IDT that is formed on the piezoelectric layer and that receives and converts the acoustic wave propagating through the piezoelectric layer into a second electrical signal and outputs the second electrical signal to another of the two input-output terminals.

2. A switching device having a plurality of input-output terminals and a common terminal that are to be connected to external devices, the switching device comprising:

a switch connected to the plurality of input-output terminals and the common terminal, the switch selecting one of the plurality of input-output terminals and connecting said selected one of the plurality of input-output terminals to the common terminal; and

a delay line that is connected in parallel to the switch between two input-output terminals among the plurality of input-output terminals, the delay line comprising:

a first piezoelectric thin film resonator that includes a first piezoelectric layer, a first lower electrode, and a first upper electrode, the first lower electrode and the first upper electrode sandwiching the first piezoelectric layer, the first piezoelectric thin film resonator converting a first electrical signal input from one of the two input-output terminals into an acoustic wave; and

a second piezoelectric thin film resonator that includes a second piezoelectric layer, a second lower electrode, and a second upper electrode, the second lower electrode and the second upper electrode sandwiching the second piezoelectric layer; and

a third piezoelectric layer formed between the first piezoelectric thin film resonator and the second piezoelectric thin film resonator such that the acoustic wave generated by the first piezoelectric thin film resonator as a result of said conversion of the first electrical signal propagates through the third piezoelectric layer and is received by the second piezoelectric thin film resonator, the second piezoelectric thin film resonator converting the received acoustic wave into a second electrical signal and outputs the second electrical signal to another of the two input-output terminals.

3. The switching device according to claim 1, further comprising:

a resonator electrically connected in series between the first IDT and said one of the two input-output terminals and/or between the second IDT and another of the two input-output terminals.

4. The switching device according to claim 1, wherein

the switch is a semiconductor switch.

5. A module comprising:

the switching device according to claim 1.

6. The module according to claim 5, further comprising:

filters connected to the two input-output terminals, respectively.

7. The switching device according to claim 1, wherein a third signal passing through the switch from said one of the two input-output terminals to another of the two input-output terminals and the second signal emerging from the delay line to another of the two input-output terminals have a substantially identical amplitude and have substantially opposite phases.

8. The switching device according to claim 1, wherein

the first IDT includes a first comb-shaped electrode connected to a ground and a second comb-shaped electrode connected to said one of the two input-output terminals, and

the second IDT includes a third comb-shaped electrode connected to a ground and a fourth comb-shaped electrode connected to another of the two input-output terminals.

9. The switching device according to claim 1, wherein no electrode is formed on the piezoelectric layer between the first IDT and the second IDT.

10. The switching device according to claim 3, wherein the resonator includes a third IDT formed on the piezoelectric layer and connected in series between the first IDT and said one of the two input-output terminals and/or between the second IDT and another of the two input-output terminals.

CLAIMS

What is claimed is:

1. A switching device comprising:

a switch that selects and connects one of input-output terminals to a common terminal; and

a delay line that is connected in parallel to the switch between two terminals of the input-output terminals and delays a signal by using an acoustic wave.

2. The switching device according to claim 1, wherein

the delay line converts a first electrical signal input to a first terminal of the two terminals into the acoustic wave propagating through a piezoelectric layer, and converts the acoustic wave propagating through the piezoelectric layer into a second electrical signal and outputs the second electrical signal to a second terminal of the two terminals.

3. The switching device according to claim 1, wherein

the acoustic wave is an acoustic wave excited by a comb-shaped electrode formed on a piezoelectric layer.

4. The switching device according to claim 1, wherein

the delay line includes:

a first IDT that converts a first electrical signal input to a first terminal of the

two terminals into the acoustic wave propagating through a piezoelectric layer; and

a second IDT that converts the acoustic wave propagating through the piezoelectric layer into a second electrical signal and outputs the second electrical signal to a second terminal of the two terminals.

5. The switching device according to claim 1, wherein

the acoustic wave is an acoustic wave excited by a thickness vibrator using a piezoelectric layer.

6. The switching device according to claim 1, wherein

the delay line includes:

a first piezoelectric thin film resonator that converts a first electrical signal input to a first terminal of the two terminals into the acoustic wave propagating through a piezoelectric layer; and

a second piezoelectric thin film resonator that converts the acoustic wave propagating through the piezoelectric layer into a second electrical signal and outputs the second electrical signal to a second terminal of the two terminals.

7. The switching device according to any one of claims 1 to 6, further comprising:

a resonator connected in series with the delay line between the two terminals.

8. The switching device according to any one of claims 1 to 7, wherein

the switch is a semiconductor switch.

9. A module comprising:

the switching device according to any one of claims 1 to 8.

10. The module according to claim 9, further comprising:

filters connected to the two terminals.