WHAT IS CLAIMED IS:

1. A laterally excited bulk acoustic wave device comprising:

a first solid acoustic mirror;

a second solid acoustic mirror;

a piezoelectric layer positioned between the first solid acoustic mirror and the second solid acoustic mirror;

an interdigital transducer electrode on the piezoelectric layer, the interdigital transducer electrode arranged to laterally excite a bulk acoustic wave, the first solid acoustic mirror and the second solid acoustic mirror arranged to confine acoustic energy of the bulk acoustic wave; ~~and~~

a support substrate arranged to dissipate heat associated with the bulk acoustic wave, the first solid acoustic mirror being positioned on the support substrate; and

a second substrate configured to dissipate heat associated with the bulk acoustic wave, the first solid acoustic mirror and the second solid acoustic mirror both being positioned between the support substrate and the second substrate.

~~2. The laterally excited bulk acoustic wave device of claim 1 further comprising a second substrate configured to dissipate heat associated with the bulk acoustic wave, the first solid acoustic mirror and the second solid acoustic mirror both being positioned between the support substrate and the second substrate.~~

~~3.~~2. The laterally excited bulk acoustic wave device of claim 1 wherein the first solid acoustic mirror is arranged to confine acoustic energy such that the support substrate is free from acoustic energy during operation of the laterally excited bulk acoustic wave device.

~~4.~~3. The laterally excited bulk acoustic wave device of claim 1 wherein the first solid acoustic mirror is an acoustic Bragg reflector that includes alternating low impedance and high impedance layers.

~~5.~~4. The laterally excited bulk acoustic wave device of claim ~~4~~ 3 wherein at least one of the low impedance layers and at least one of the high impedance layers are free from acoustic energy during operation of the laterally excited bulk acoustic wave device.

~~6.~~5. The laterally excited bulk acoustic wave device of claim ~~4~~ 3 wherein the high impedance layers each have a thickness in a range from about 0.14 λ_p to 0.30 λ_p or from about 0.35 λ_p to 0.45 λ_p, in which λ_p is a wave length of longitudinal wave velocity.

~~7.~~6. ~~The~~ A laterally excited bulk acoustic wave device ~~of claim 1~~ comprising:

a first solid acoustic mirror;

a second solid acoustic mirror;

a piezoelectric layer positioned between the first solid acoustic mirror and the second solid acoustic mirror, ~~wherein~~ the piezoelectric layer ~~has~~ having a thickness in a range from 0.2 micrometers to 0.4 micrometers;

an interdigital transducer electrode on the piezoelectric layer, the interdigital transducer electrode arranged to laterally excite a bulk acoustic wave, the first solid acoustic mirror and the second solid acoustic mirror arranged to confine acoustic energy of the bulk acoustic wave; and

a support substrate arranged to dissipate heat associated with the bulk acoustic wave, the first solid acoustic mirror being positioned on the support substrate.

~~8.~~7. The laterally excited bulk acoustic wave device of claim 1 wherein the piezoelectric layer is an aluminum nitride layer.

~~9.~~8. The laterally excited bulk acoustic wave device of claim 1 wherein the piezoelectric layer is a lithium niobate layer or ~~-~~a lithium tantalate layer.

~~10.~~9. The laterally excited bulk acoustic wave device of claim 1 wherein the laterally exited bulk acoustic wave device has a resonant frequency in a range from 4.5 gigahertz to 10 gigahertz.

~~11.~~10. The laterally excited bulk acoustic wave device of claim 1 wherein the laterally exited bulk acoustic wave device has a resonant frequency in a range from 10 gigahertz to 25 gigahertz.

~~12.~~11. A laterally excited bulk acoustic wave component comprising:

a first substrate;

a first solid acoustic mirror on the first substrate;

a piezoelectric layer on the first solid acoustic mirror;

an interdigital transducer electrode on the piezoelectric layer, the interdigital transducer electrode arranged to laterally excite a bulk acoustic wave;

a second solid acoustic mirror on the piezoelectric layer and the interdigital transducer electrode, the first solid acoustic mirror and the second solid acoustic mirror together arranged to confine acoustic energy of the bulk acoustic wave; and

a second substrate on the second solid acoustic mirror, the first and second solid acoustic mirrors being positioned between the first and second substrates, the first and second substrates arranged to dissipate heat associated with the bulk acoustic wave.

~~13.~~12. The laterally excited bulk acoustic wave component of claim ~~12~~ 11 further comprising a conductive via extending through the second substrate, wherein the conductive via is electrically connected to a laterally excited bulk acoustic wave resonator that includes the interdigital transducer electrode.

~~14.~~13. The laterally excited bulk acoustic wave component of claim ~~12~~ 11 further comprising a third solid acoustic mirror on the second substrate, a second piezoelectric layer on the third solid acoustic mirror, and a second interdigital transducer electrode on the second piezoelectric layer.

~~15.~~14. A stacked acoustic wave device assembly comprising:

a first support substrate;

a first laterally excited bulk acoustic wave stack on the first support substrate; the first laterally excited bulk acoustic wave stack including a first piezoelectric layer,

a first interdigital transducer electrode on the first piezoelectric layer, and a pair of solid acoustic mirrors on opposing sides of the first piezoelectric layer;

a second support substrate positioned on the first laterally excited bulk acoustic wave stack; and

a second laterally excited bulk acoustic wave stack on the second support substrate, the second laterally excited bulk acoustic wave stack including a second piezoelectric layer, a second interdigital transducer electrode on the second piezoelectric layer, and a solid acoustic mirror positioned between the second piezoelectric layer and the second support substrate.

~~16.~~15. The stacked acoustic wave device assembly of claim ~~15~~ 14 wherein the solid acoustic mirror is included in a second pair of solid acoustic mirrors, the second pair of solid acoustic mirrors being on opposing sides of the second piezoelectric layer.

~~17.~~16. The stacked acoustic wave device assembly of claim ~~15~~ 14 further comprising a third substrate over the second laterally excited bulk acoustic wave stack.

~~18.~~17. The stacked acoustic wave device assembly of claim ~~15~~ 14 further comprising an adhesion layer positioned between the second support substrate and the solid acoustic mirror.

~~19.~~18. The stacked acoustic wave device assembly of claim ~~15~~ 14 wherein the first laterally excited bulk acoustic wave stack and the second laterally excited bulk acoustic wave stack are included in a single acoustic wave filter arranged to filter a radio frequency signal.

~~20.~~19. The stacked acoustic wave device assembly of claim ~~15~~ 14 wherein the first piezoelectric layer has a thickness in a range from 0.2 micrometers to 0.4 micrometers.

20. The laterally excited bulk acoustic wave device of claim 6 wherein the piezoelectric layer is an aluminum nitride layer, the piezoelectric layer is a lithium niobate layer or a lithium tantalate layer, and the laterally exited bulk acoustic wave device has a resonant frequency in a range from 10 gigahertz to 25 gigahertz.