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# THERMAL SOLUTION - EXPANDED HEATSINK

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# *Thermal solution - expanded heatsink*

- ### Abstract

The concept is to give a heatsink fin that can transform geometry ability. The purpose is to enlarge the heatsink size to increase the heat dissipated area and increase the flow space to improve flow convention efficiency.

- ➢ Thermal part

  - ○ Fin: a flexible or adjustable fin structure that can increase the width of Air flow space from D to (D+½ d), which would help decrease the flow speed to reduce the noise.

  - ○ Fan: Where fins transform, and the air gap between the desk and NB bottom surface (bottom air inlet) is also increased, the fan can suck air with better efficiency and noise will be lower at the same fan speed.
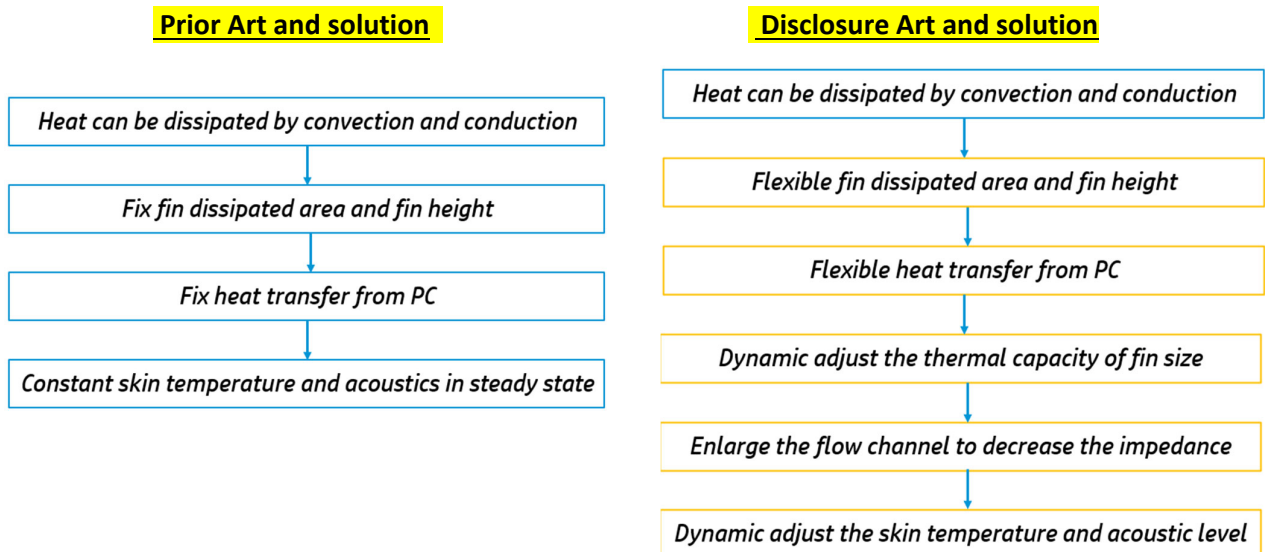
- ➢ ME part

  - ○ The transformation structure is designed on thermal fin and D-cover
  - ○ The transformation is triggered by an ambient sensor that detects the system temperature.
    - 1) System temperature is high and over the T,limit
    - 2) System still has the margin that can be triggered CPU/GPU overclocking
  - ○ D-cover (bottom fin was fixed together) and was fixed at C- cover by another side. D-cover with a bottom fin can be pushed up and down by a small motor.
- ➢ PCA part
  - ○ Keyboard use Hotkey or special button to control Expand FIN.
  - ○ When detect Over temperature event to do some actions.

- ### Solution comparison

      

| Prior Art and solution |
| --- |
| Heat can be dissipated by convection and conduction |
| Fix fin dissipated area and fin height |
| Fix heat transfer from PC |
| Constant skin temperature and acoustics in steady state |

| Disclosure Art and solution |
| --- |
| Heat can be dissipated by convection and conduction |
| Flexible fin dissipated area and fin height |
| Flexible heat transfer from PC |
| Dynamic adjust the thermal capacity of fin size |
| Enlarge the flow channel to decrease the impedance |
| Dynamic adjust the skin temperature and acoustic level |

- ## **Detailed description of the working mechanism**

Step I. User-customized function by PCA design

1. Use the hotkey of the keyboard or a special button to control the expansion of FIN.
2. Execute the below corresponding event when detecting the over-temperature signals
    1) CPU over HP-customized temperature specifications.
    2) dGPU over HP-customized temperature specifications.
    3) VRs/SSD or other key components over HP-customized temperature specifications.
3. The user can customized-modify the OTP trigger value so that the extended FIN can be automatically turned on in advance to obtain higher performance or a quieter sound experience.
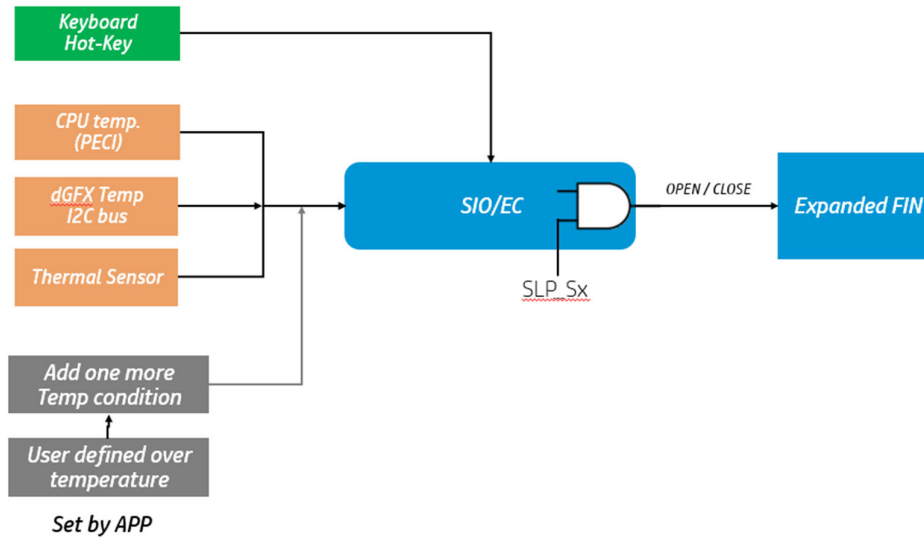


Step II. Expansion FIN mechanism by ME design

4. Two fins (Top and Bottom) structure at NB heatsink here, both HS was fixed at one rotatable hinge. Heat was dissipated from heat-pipe to two both fins.
5. Bottom fin was fixed with NB sec D-cover by screw.
6. D-cover (bottom fin was fixed together) and was fixed at C- cover by another side. D-cover with a bottom fin can be pushed up and down by a small motor.

Step III. How the expansion FIN increase the thermal capacity and efficiency

7. A flexible or adjustable fin structure that can increase the width of Air flow space from D to (D+½ d), which would help decrease the flow speed to reduce the noise.
8. Heatsink fin transform and enlarge heatsink dissipated volume about 40% (Top+Bottom fins)
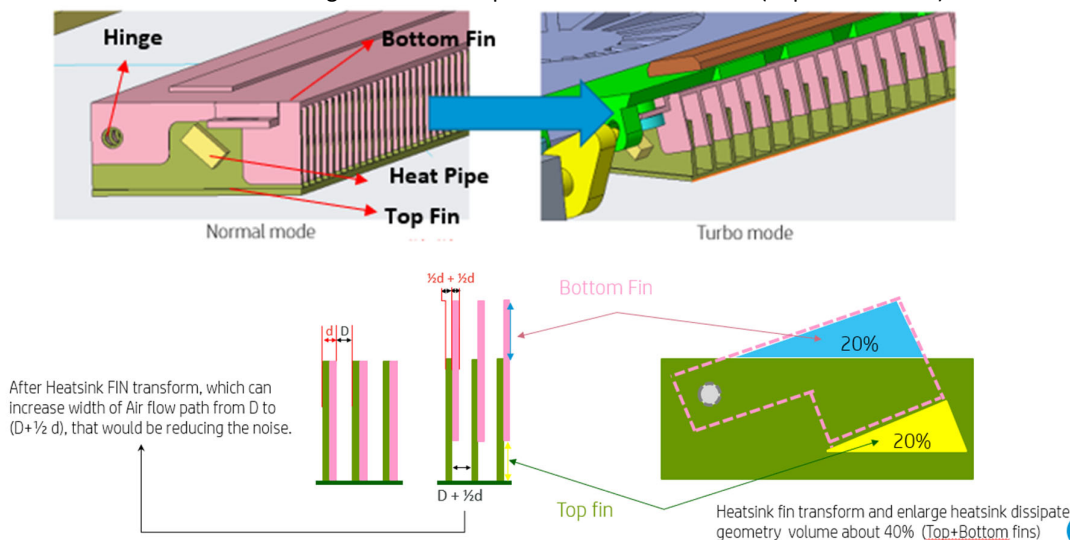
9. Where fins transform, and the air gap between the desk and NB bottom surface (bottom air inlet) is also increased, the fan can suck air with better efficiency and noise will be lower at the same fan speed.
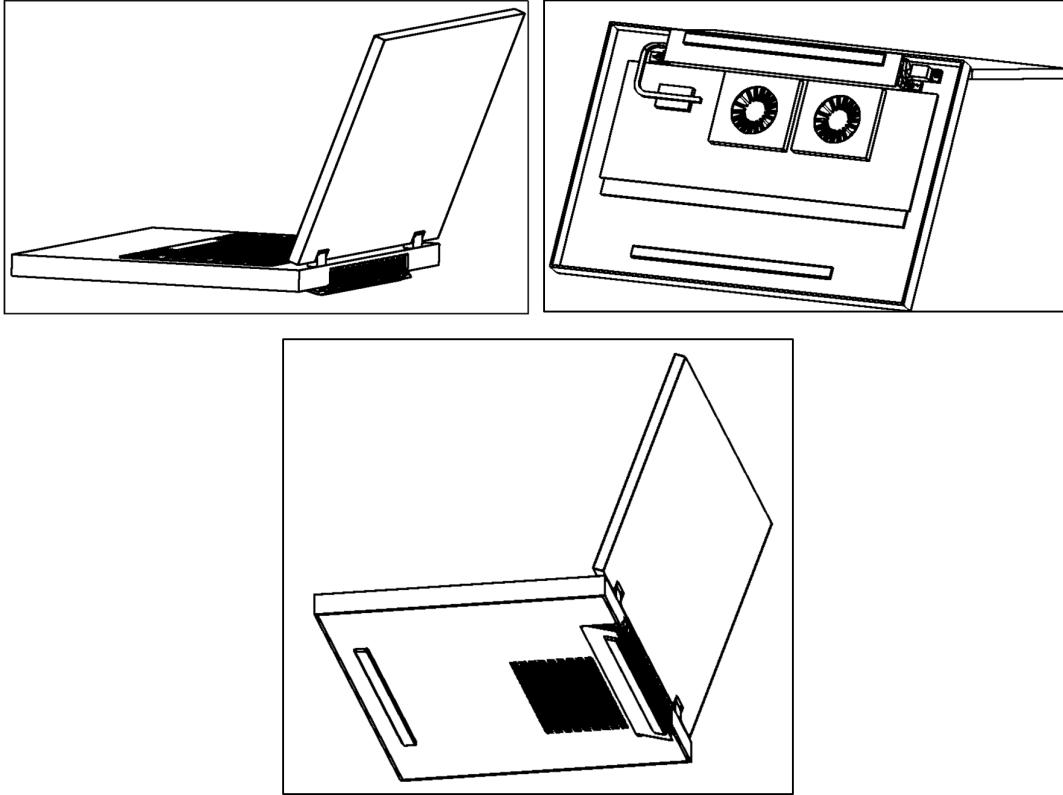


- **Advantages**
1. What is the pain-point:
    1) Existing thermal conditions have limited system performance.
    2) The system CPU temperature is easy to heat up by heavy loading result in performance drop.
    3) Poor air intake and air flow
    4) Small heatsink area to limit heat dissipation
    5) Acoustic specification/requirement limit Fan Speed to induce system getting higher temperature.
2. What we solve the pain-point and what is the innovation solutions?
    1) Enlarge heatsink Fin and air inlet gap spacing.
    2) Smart control of heatsink expanding or closing
3. Potential product that we can implement?
    1) Performance NB
    2) Gaming NB
4. The transformation structure is designed on thermal fin and D-cover, and the transformation is triggered by an ambient sensor that detects the system temperature.
    1) System temperature is high and over the T,limit
    2) System still has the margin that can be triggered CPU/GPU overclocking

*Disclosed by Bowway Chen, Marc Tsai, Sting Yu, Iring Chiu, HP Inc.*