

(12) **United States Patent**  
**Chainer et al.**

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(54) **PASSIVE TWO-PHASE COOLING WITH FORCED COOLING ASSIST**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(58) **Field of Classification Search**

CPC ..... H05K 7/20209; H05K 7/20281; H05K 7/20381; H05K 7/207; H05K 7/20836; G06F 1/206; G06F 1/32-1/3296  
See application file for complete search history.

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(57) **ABSTRACT**

Techniques that facilitate two-phase liquid cooling electronics are provided. In one example, a system comprises a pump and a valve. The pump circulates a coolant refrigerant through a two-phase refrigerant system associated with an electronic component. The valve controls a flow path of the coolant refrigerant that flows through the two-phase refrigerant system. Furthermore, the valve modifies the flow path of the coolant refrigerant through the two-phase refrigerant system in response to a determination that an operation of the pump satisfies a defined criterion.

**14 Claims, 11 Drawing Sheets**

