Enhancing the hydrothermal performance of plate-fin microchannels heat sink (PFMCHS) promises smaller size and lighter weight, and then improve the heat removal in consequently increase the speed of electronic devices. In this numerical study, an innovative hydrothermal design of PFMCHS is suggested by inserting elliptic pins inside microchannels in different; aspect ratio (AR) of pin, pin number ratio (ψ) in order to optimize the hydrothermal design of this kind of heat sinks. The main objectives of this study are; investigating the effect of pins on the performance of PFMCHS by investigating the best geometry in the pinned-fin MCHS and which is higher, thermal or hydraulic performance of this kind of heat sinks and what is the optimal number of pins numerically and what about the pressure drop penalty in the proposed design, little, modest or high increase. It is seen that the thermal resistance of the pinned fin MCHS is about 50% lower, and pressure drop of it is much higher than that of the (PFMCHS) under the condition of equal wind velocity. Maximum mechanical fan power reduction obtained is about 57% for the pinned fin MCHS with ψ = 1 and Dh = 1 ×10-3 m compared to the corresponding original channel heat sink. To show the overall performance of the two parameters; aspect ratio (AR), pin number ratio (ψ), the overall JF factor is estimated and the concrete findings shows that the best hydrothermal performance is obtained at the greater aspect ratio which is around overall JF = 1.2. In addition, the trend of overall JF is going down with the pin number ratio, starting from 1.2 to 1.15. And the concrete findings show that pinned fin MCHS provides thermal performance of 1.42 times greater than the smooth one under the corresponding conditions when one pin is used in each channel.