The benefits of using pinned heat sinks (PHSs) with multiple circular, square and elliptic perforations for electronic cooling applications are investigated using Computational Fluid Dynamics (CFD). A conjugate heat transfer analysis, using the RANS-based modified k-ω turbulence model, is used to determine the effect of perforation shape on the cooling and hydraulic performance of PHSs. The numerical solutions indicate that the optimum design will be a compromise between elliptical perforations, which minimize pressure drop and mechanical fan power consumption, and circular perforations, which provide the most effective heat transfer. Employing staggered arrangements of perforated pins in PHS is also shown to be highly beneficial and to enable the power consumption required to cool a heat sink to a target temperature to be reduced significantly.