The benefits of using pin fin heat sinks with multiple perforations are investigated using complementary experimental and Computational Fluid Dynamics (CFD) methods. An experimental heat sink with multiple perforations is designed and fabricated and parameter studies of the effect of perforated pin fin design on heat transfer and pressure drops across the heat sinks undertaken. Experimental data is found to agree well with predictions from a CFD model for the conjugate heat transfer into the cooling air stream. The validated CFD model is used to carry out a parametric study of the influence of the number and positioning of circular perforations, which shows that the Nusselt number increases monotonically with the number of pin perforations, while the pressure drop and fan power required to overcome the pressure drop all reduce monotonically. Pins with five perforations are shown to have a 11% larger *Nu* than for corresponding solid pin cases. These benefits arise due to not only the increased surface area but also heat transfer enhancement near perforations through the formation of localised air jets. In contrast, the locations of the pin perforations are much less influential. When examined in the context of CPU cooling, a conjugate heat transfer analysis shows that improved heat transfer with pin perforations translates into significantly reduced processor case temperatures with the additional benefit of a reduction in the weight of the heat sink's pins. To achieve these benefits care must be taken to ensure that pin perforations are aligned with the dominant flow direction and manufactured with a good quality surface finish.