5. CONCLUSIONS

Numerical simulations were conducted to study the heat transfer and fluid flow characteristics of a liquid-cooled heat sink with water/glycol mixtures as working coolant. The analysis was focused on channel geometric construction, channel number, and coolant effect. The conclusions have been summarized.

(1) Alternating rectangular channel can provide high heat transfer performance, with a little penalty in hydraulic resistance. Because the device temperature is always the major concern compared to pumping power, the alternating rectangular channel should be widely applied to power electronics cooling.

(2) The cooling channels in heat sink have an optimal number to provide the maximum thermal performance and hence the minimum surface temperature. It is resulted from the associated effect of heat convection resistance at channel surface and heat conduction resistance in heat sink solid part. The pressure drop is always increased with channel number.

(3) Water/glycol mixture has an optimal operating temperature to provide the maximum cooling performance.

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NOMENCLATURES

A	heat transfer area (m2)
D	equivalent diameter (mm)
k	thermal conductivity (W/(K·m))
L	length of the heat sink(mm)
P	pressure (Pa)
Q	total heat generation (W)
q	heat flux (W/m2)
Re	Reynolds number
T	temperature (K); thickness of the heat sink(mm)
u, v, w	velocity component along x, y, z (m/s)
V	volume flow of the heat sink(m3/s)
W	width of the heat sink(mm)
x, y, z	coordinate directions (mm)

Greek symbols

Δ	difference
ρ	density (Kg/m3)
μ	dynamic viscosity ((N·s)/ m2)
λ	thermal conductivity (W/(K·m))

Subscripts

f	fluid
in	inlet
max	maximum
out	outlet
s	solid
w	wall
c	channel