

Heat Sink Design Cheat Sheet

Thermal resistance and sizing a heat sink

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Junction temperature	$T_j = T_a + P \sum R$	R in K/W
Resistance chain	$R_{ja} = R_{jc} + R_{cs} + R_{sa}$	Junction-case, case-sink (interface), sink-ambient
Required sink resistance	$R_{sa} \leq (T_{j,max} - T_a)/P - R_{jc} - R_{cs}$	Pick a sink at or below this
Convective resistance	$R_{sa} = 1 / (h A_{eff})$	A_{eff} includes fin efficiency
Fin efficiency	$\eta_f = \tanh(m L) / (m L), m = \sqrt{(h P_f / (k A_c))}$	Straight fin, adiabatic tip
Fin heat rate	$q_f = \eta_f h A_f (T_b - T_\infty)$	

Key takeaways

- Size the sink from the thermal budget: allowable temperature rise divided by power, minus the other resistances.
- More fin area helps until fin efficiency falls or fins crowd each other and choke airflow.
- A thermal interface material lowers R_{cs} ; forced air lowers R_{sa} sharply versus natural convection.
- FLAG: the article's worked example is not reproduced here (its numbers could not be read in this pass). The relations are standard textbook forms; check them against the article.