NOREN™
THERMAL SOLUTIONS

THERMAL MANAGEMENT CONCEPTS

Proper thermal management of a project involves understanding the thermal budget and understanding the three strategies employed in managing heat. These strategies are heat spreading, heat movement, and heat dissipation. In addition to this, the three ways that heat is transferred must also be understood. Heat transfer is accomplished by conduction, convection, or radiation.

HEAT SPREADING

Heat spreading takes the heat from a heat source with a high heat-flux density and spreads it out using a second material of larger cross sectional area, surface and volume.

HEAT MOVEMENT

Heat movement transfers the heat from a source to a heat sink located a distance away from the source. The heat is transferred with minimal losses.

HEAT DISSIPATION

Heat dissipation occurs by spreading or dispersing the heat into another medium (such as air or water) or by radiation. The rate at which heat is dispersed depends upon the turbulence between the object and the medium and the velocity of the medium.

CONDUCTION HEAT TRANSFER

Conduction refers to movement of heat in a solid.

Convection refers to transfer of heat from a solid to a fluid (such as a liquid or gas).There are two types of convective heat transfer:

- **Natural convection:** when the fluid motion is caused by buoyancy forces that result from the density variations due to temperature change in the fluid. For example, in the absence of an external source, when the mass of the fluid is in contact with a hot surface its molecules separate and scatter causing the mass of fluid to become less dense. When this happens, the fluid is displaced vertically or horizontally while the cooler fluid gets denser and the fluid sinks. Thus the hotter volume transfers heat towards the cooler volume of that fluid.

- **Forced convection:** when the fluid is forced to flow over the surface by external source such as fans and pumps, creating an artificially induced convection current.

RADIATION HEAT TRANSFER

Radiation refers to heat transfer through the emission of electromagnetic waves.

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