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Side-cooling of pluggable optical transceiver modules

Existing industry standard MSA (multi-sourced agreement) optical transceiver modules (e.g., QSFP) are plugged into cages with heat sinks attached that are mounted in servers and switches. The heat sink interface between the optical transceiver housing and the cage heat sink is a high thermal impedance interface due to the lack of compression, flatness and high surface roughness.

New MSA module form factors, including micro-QSFP, QSFP-DD and OSFP, are emerging to accommodate high-radix switches, since existing MSA transceivers do not support the density required in a common 1U switch form factor. Therefore, new, denser optical MSA modules are expected to have a higher thermal density (W/mm^3), where the existing interface to the cage heat sinks may not be sufficient to cool the modules installed in the cages. These new MSA modules are specified to have integrated heat sinks on the modules while their respective cages host vent holes to allow airflow from front-to-back through the faceplate.

However, front-to-back cooling of the new MSA modules will not work for systems (blade enclosure switches, two pole mount switches) that seal against through faceplate cooling and instead rely on an airflow path perpendicular to the cage and parallel to the faceplate. Below are examples of existing MSA modules with front to back cooling.

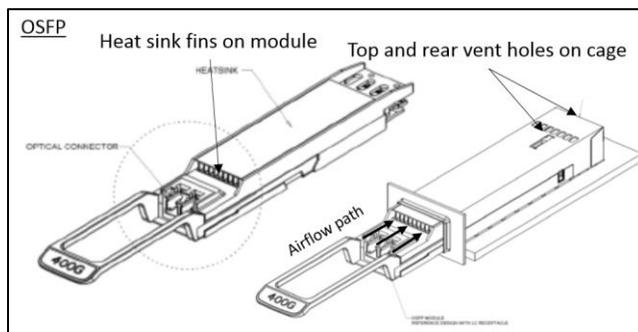
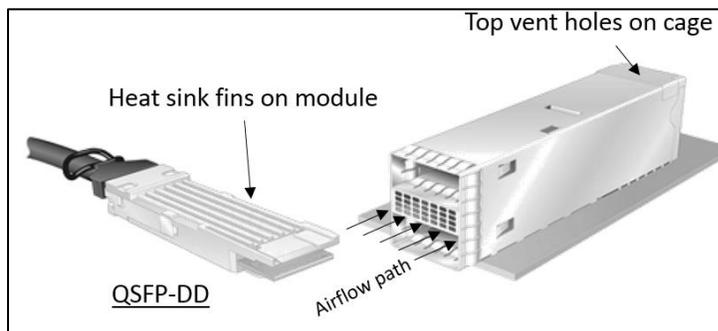


Figure 1: QSFP-DD Airflow Path

Figure 2: OSFP Airflow Path

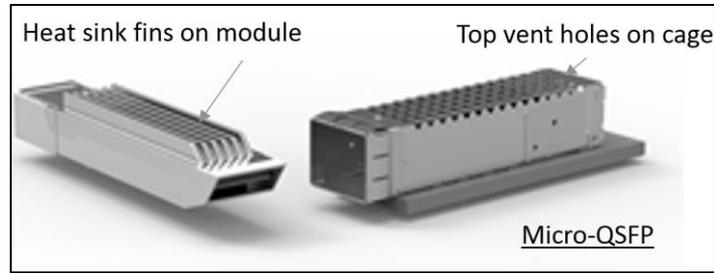


Figure 3: Micro-QSFP Airflow Path

The following descriptions and images describe side cooling methods to enable an airflow path through modified new high density MSA module cages and shells, but utilize the same module paddle cards that contain opto-electronics. This is achieved by creating slots in the cages and module shells to allow air flow through the module, in orthogonal direction with respect to the optical transceiver module. The figures below explain this at a high level:

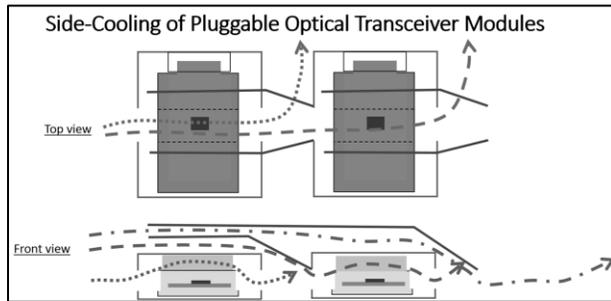


Figure 4: Side-cooling of transceivers concept

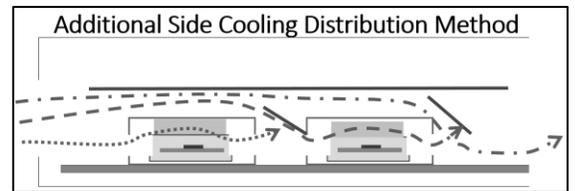


Figure 5: Side-cooling of transceivers concept for multiple in line transceivers

Heat sinks on the module and/or above the adjacent cages allow air to be directed to the downstream heatsinks. Airflow is managed using baffles that direct portions of the airstream to specific transceivers to avoid pre-heat aggregation impacting downstream transceivers. Air can also be provided a path to direct cool air to the rear area of a server where preheat can be a concern.

The figures below describe specific implementations in rack mount and blade switches.

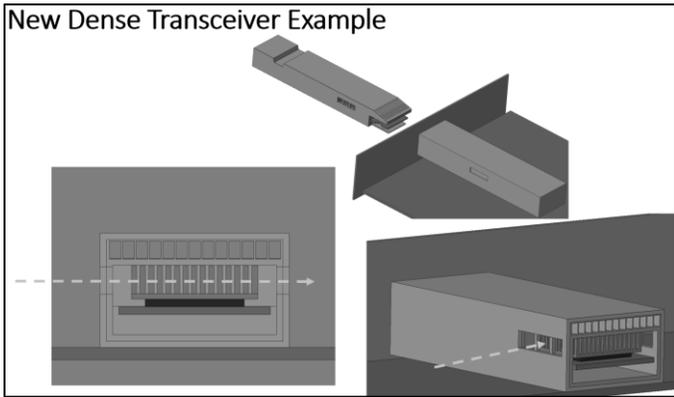


Figure 6: Side-cooling of transceivers concept

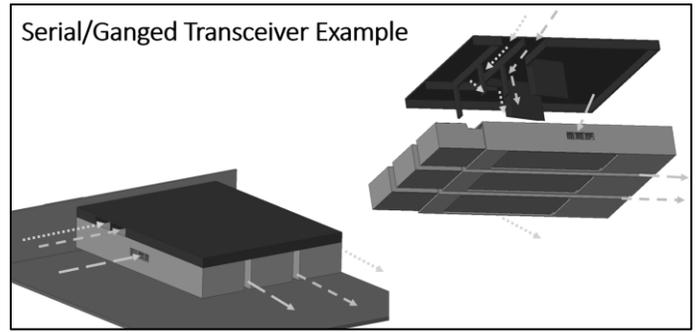


Figure 7: Side-cooling of transceivers concept for multiple in line transceivers

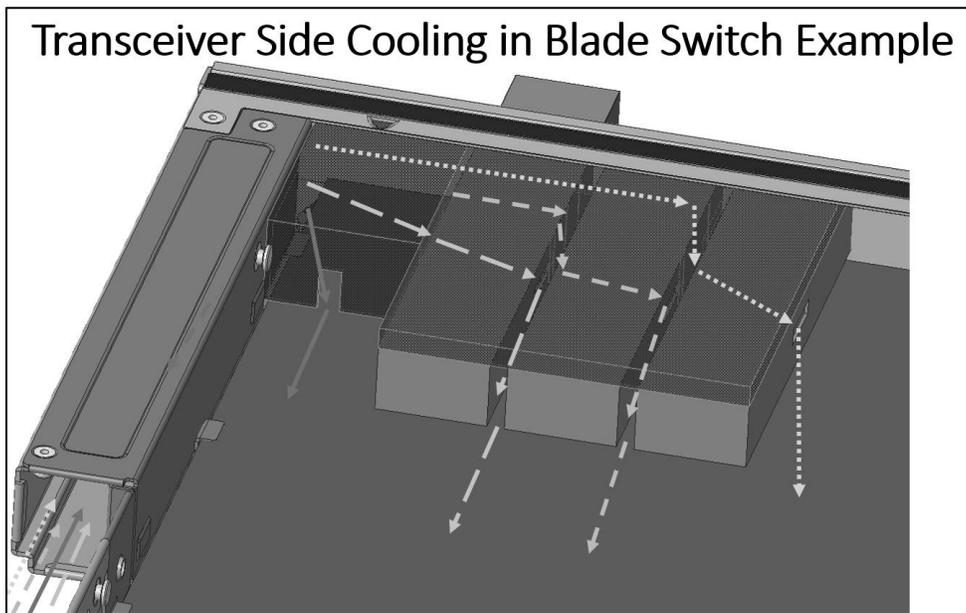


Figure 8: Side-cooling of transceivers concept for multiple in line transceivers

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