

# **Data Center Rack Thermal Design**





## Overview

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Thermal Load Assessment: Identify rack-level power distribution and peak heat output to ensure sufficient cooling redundancy. This guide provides an overview of best practices for energy-efficient data center design which spans the categories of information technology (IT) systems and their environmental conditions, data center air management, cooling and electrical systems, and heat recovery. Special thanks also to Dave Kelley (Emerson), Paul Artman (Lenovo), John Groenewold (Chase), William Brodsky (IBM). Increasing needs of functionality and power level with limited spaces in server and telecommunication power supplies drive the adoption of wide-bandgap devices (including gallium nitride (GaN)), more accurate sensing circuits, and more complex real-time control. Rack cooling shifts the focus from room-level to cabinet-level precision cooling, delivering cold air directly to the heat source and recovering hot air immediately at the rack. This close-coupled cooling method not only improves thermal efficiency but also reduces energy consumption and. Liquid cooling—specifically Direct-to-Chip (D2C) or Cold Plate technology—has emerged as the standard solution for.



## Data Center Rack Thermal Design

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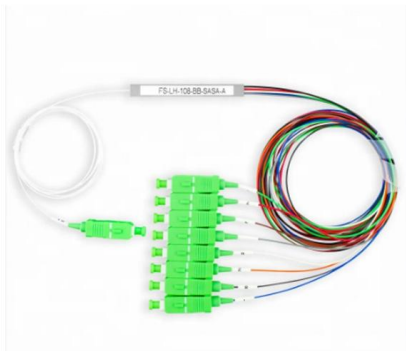


### Best Practices Guide for Energy-Efficient Data Center Design

This guide concludes with a section on metrics and benchmarking values by which a data center and its systems energy efficiency can be evaluated. No design guide can offer "the most energy-efficient"

### Future-Proof Your Data Center for AI: A Checklist for

How To Design and Build AI-Ready Data Centers: A Checklist A data center that is truly AI-ready must be able to support high-density compute, low

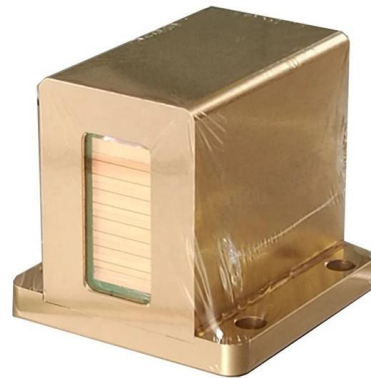


### Experimental and optimization research of the rack thermal

Based on the characteristics of data center power consumption, the response of the rack thermal environment to power consumption changes, server number and layout are presented.

### Comprehensive Guide to Rack Cooling in Data Centers

Rack cooling systems have therefore emerged as one of the most essential and effective thermal management solutions in modern data centers. In traditional data centers, cooling was primarily



### **Rack power & thermal management design resources , TI**

As data centers transition to liquid cooling solutions for high-density AI and high-performance computing workloads, our C2000 digital controllers enable precise thermal management, while our motor drivers



### **Liquid cooling solutions for AI and high-density data**

Schneider Electric's data center liquid cooling solutions are purpose-built for AI workloads, GPU servers, and high-density IT environments. With over a decade



### **Innovative Thermal Solutions for High-Density Server Racks**

Innovative Thermal Solutions for High-Density Server Racks The world of computer hardware manufacturing is continuously evolving, and one of its most critical challenges is managing thermal





## **(PDF) Effects of Servers' Rack Location and Power**

Effects of server/rack locations and server loading configurations on the thermal performance of data center racks' array are experimentally investigated using a



## **Energy and Water Efficiency Metrics in Data Center**

Learn essential energy and water efficiency metrics for data center cooling systems. Compare traditional towers vs immersion cooling with expert analysis of PUE,

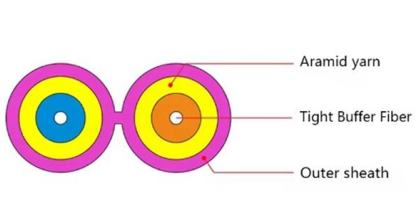
## **Europe Data Center Cooling and Thermal Management Forum 2026**

Explore how AI workloads are transforming data center demand, design, and deployment strategies across Europe and globally. 2, Deep Dive into Next-Gen Cooling Technologies From direct-to-chip



## **AFCOM: Rack Density Surges as AI Overhauls Data**

AFCOM: Rack Density and Build-Outs Surge as AI Overhauls Data Center Design AFCOM's 10th State of the Data Center report finds operators are





## Why Liquid Cooling Is Becoming the Data Center Standard

The thermal transfer properties of air pale in comparison to liquids. The energy and space requirements of air cooling systems now consume an



## Optimization of data center thermal management

These findings demonstrate that heat pipe backplane systems offer significant advantages in optimizing internal rack airflow organization, mitigating

## Optimizing Cooling Efficiency in Modern Data Centers

Optimizing Cooling Efficiency in Modern Data Centers Cooling systems in data centers account for roughly 30% to 40% of total energy consumption. As



## Server Rack Heat Dissipation in Next Generation In-Row Architectures

In-Row architectures are versatile and modular, allowing for cooling to be approached on a row or rack scale, with the capability to easily adapt this cooling solution throughout the life of the data centre in



## Optimizing Data Center Systems , TE Connectivity

Today's design challenge includes increasing computing performance in higher-power data racks while managing thermal performance. Achieving this requires electrical and electronic components



## NVIDIA Blackwell Platform Boosts Water Efficiency by

By reducing dependence on chillers and enabling more efficient heat rejection, liquid cooling is driving the next generation of high-performance, energy

## ASHRAE TC9.9 Data Center Power Equipment Thermal Guidelines

Data Center Power Equipment Thermal Guidelines and Best Practices Whitepaper created by ASHRAE Technical Committee (TC) 9.9 Mission Critical Facilities, Data Centers, Technology Spaces, and



## The Impact of Data Center Rack Design on Cooling

The design and layout of data center racks significantly impact cooling efficiency and overall thermal management. As data centers continue to



## Optimization of data center thermal management

To address localized hotspot issues arising from traditional cooling methods in high-power-density data centers and to ensure a stable thermal



## Data Center Market Size, Share & Forecast Report, 2034

The global data center market size is projected to grow from USD 300.64 billion in 2026 to USD 699.13 billion by 2034, at a CAGR of 11.10% during the forecast

## ASHRAE TC9.9 Data Center Power Equipment Thermal Guidelines

the data center thermal environment may affect power distribution equipment. This paper also provides an overview of data center power distribution and describes the typical power.



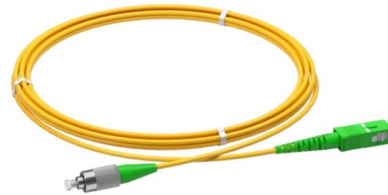
## Engineering Liquid Cooling: A Guide to Direct-to-Chip

Practical guide to direct-to-chip liquid cooling in AI data centers--cold plate cooling, CDUs, hydraulics, water chemistry management, leak prevention,



## Data Center Rack Cooling Guide to Efficiency and

For data center managers, IT engineers, and facility operators, this is the ultimate guide to overcoming thermal challenges and maximizing the



## Comprehensive Guide to Rack Cooling in Data Centers

Key Considerations for Deploying Rack Cooling Systems Thermal Load Assessment: Identify rack-level power distribution and peak heat output to ensure sufficient cooling redundancy. Airflow



## How to Maximise Data Center Efficiency with Server Racks

Learn how efficient server rack design and layout can improve airflow, cooling, and cable management to maximize your data center's performance.



## NVIDIA Blackwell Platform Boosts Water Efficiency by

By embracing high-density architectures and advanced liquid cooling, the industry is paving the way for a more efficient AI-powered future. Learn more



### AI Server Data Center Cost Breakdown: 2025

Explore the real costs of deploying AI-ready infrastructure, from GPU servers to advanced cooling and power delivery. Learn how to plan and optimize



### Data Center Liquid Cooling Market , Industry Report, 2033

Data Center Liquid Cooling Market Summary The global data center liquid cooling market size was estimated at USD 6.65 billion in 2025 and is projected to reach



### Best Practices Guide for Energy-Efficient Data Center Design

This guide provides an overview of best practices for energy-efficient data center design which spans the categories of information technology (IT) systems and their environmental conditions, data center



### Rack-level cooling technologies for data centers - A comprehensive

The rack-level systems adopting on-demand direct cooling are regarded as a promising solution for data center cooling. Corresponding system design, operation control characteristics,





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