System Solution Guide - Preview

AI Data Center

onsemi.com

Table of Contents

Get Latest Version

Full Guide Preview

Get Latest Version

1


2


3


4


5


6

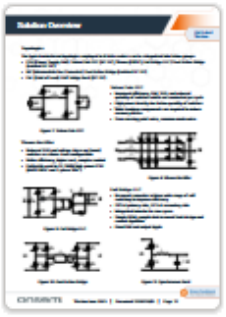

7

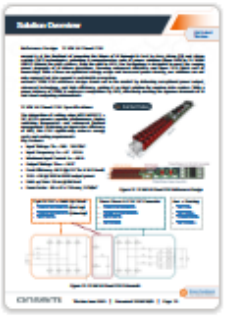

8


9


10

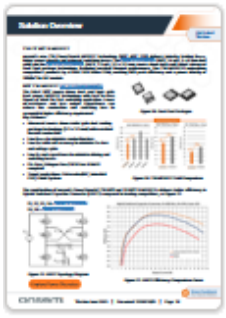

11


12


13

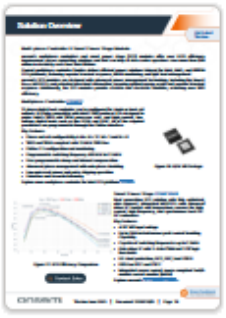

14

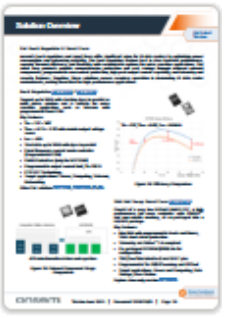

15


16


17


18


19

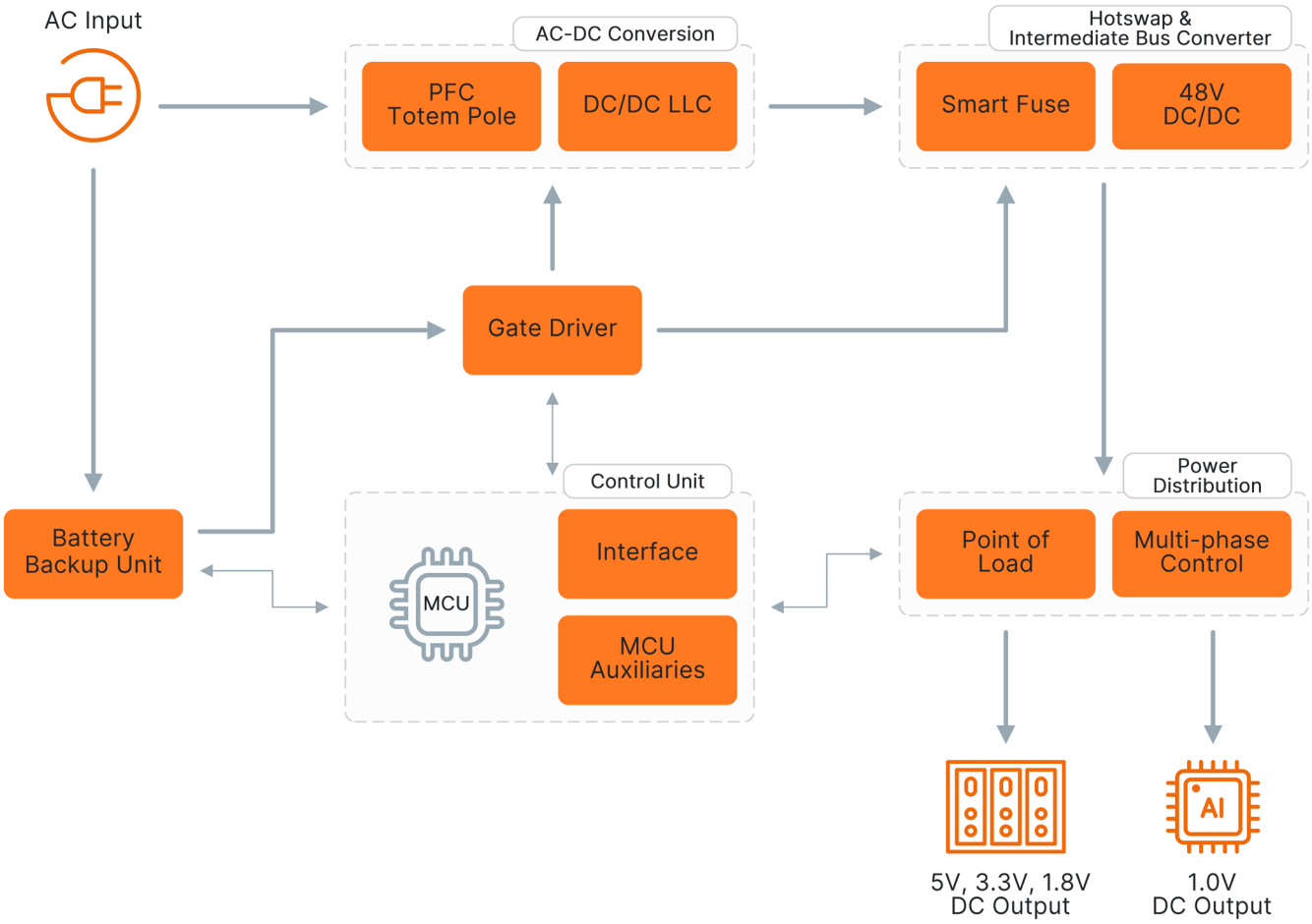

20

Block Diagram - AI Data Center

Get Latest Version

Block Diagram - AI Datacenter

The block diagram below represents AI datacenter solution recommended by **onsemi**. The diagram illustrates both AC-DC conversion and DC-DC power distribution stages utilized in AI data centers. **onsemi's** integrated approach leverages complementary products including cutting-edge Si, SiC and GaN technologies for power switching. Additionally, it incorporates gate drivers, multi-phase controllers & 48V controller, smart power stage (SPS) modules, smart fuses and PoL buck converters for power management. This combination enables systems with enhanced efficiency and increased power density, resulting in a smaller footprint.



Use our Interactive Block Diagrams Tool

Open IBD Tool

Get Latest Version

Reference Design - 12 kW AI Cloud PSU

onsemi is at the forefront of powering the future of AI through its best-in-class silicon (Si) and silicon carbide (SiC) technologies, providing a comprehensive suite of power solutions (from **3kW to 25-30kW** HVDC) tailored for data centers, from the grid to GPU. Our technology is designed to meet the surging power demands of AI-driven operations, ensuring enhanced efficiency and lower TCO (total cost of ownership). With a focus on optimized energy usage and increased power density, our solutions are not only compact but also support a sustainable ecosystem.

onsemi's 12kW PSU reference design stands out in the market by delivering exceptional power output, advanced technology, and high efficiency, making it an ideal solution for modern data centers. With a power delivery of 12kW, it surpasses competitors by 50%, effectively meeting the rigorous demands of AI and cloud computing environments.

12 kW AI Cloud PSU Specifications

The integration of cutting-edge M3S MOSFET + SiC JFETs ensures superior performance, higher switching frequencies and enhanced thermal management. Achieving an impressive efficiency of 98%, this PSU significantly reduces energy costs and cooling requirements.

Key Features

- Input Voltage: V_{IN} = 180 - 305 VAC
- Input Frequency: F_{IN} = 47 - 63 Hz
- Maximum Input Current: I_{IN} = 68 A
- Output Voltage: V_{OUT} = 50 V
- Peak Efficiency: 98 % (@ 277 V_{IN} & 50 % load)
- THD: ≤5% @ 30% to 100% output power
- Hold-up Time: 20 ms @ full load
- Form Factor: 80 x 42 x 750 mm, 75 W/in³

Contact Sales

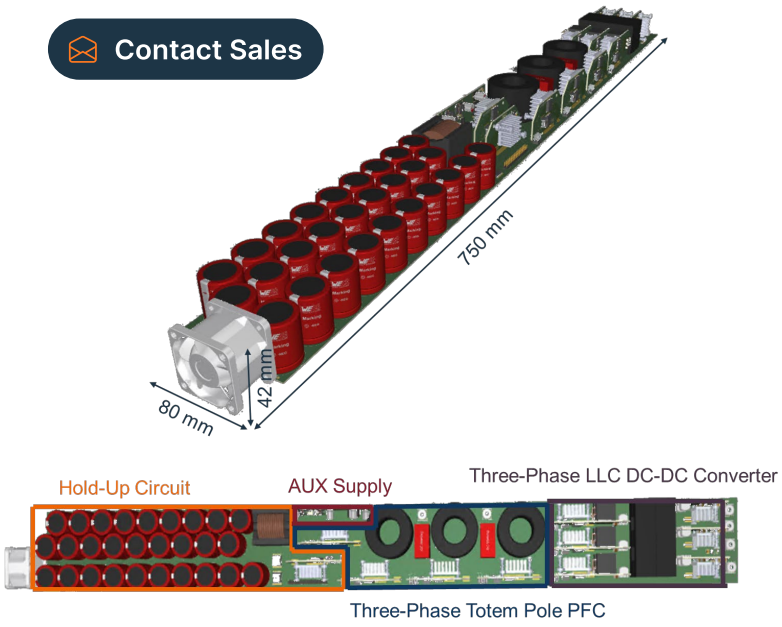


Figure 12: 12 kW AI Cloud PSU Reference Design

3-ph TP PFC + Hold-Up Circuit
- UJ4SC075018L8S (fast leg)
- UJ4SC075005L8S (slow leg)
- NCP51752

Three-Phase LLC DC-DC Converter
- UJ4SC075008L8S
- NTMFSCH1D4N08X
- NCP51752
- NCP4306

Aux. + Sensing
- NCP781
- NCP1060
- FAN65004B
- NCS20071

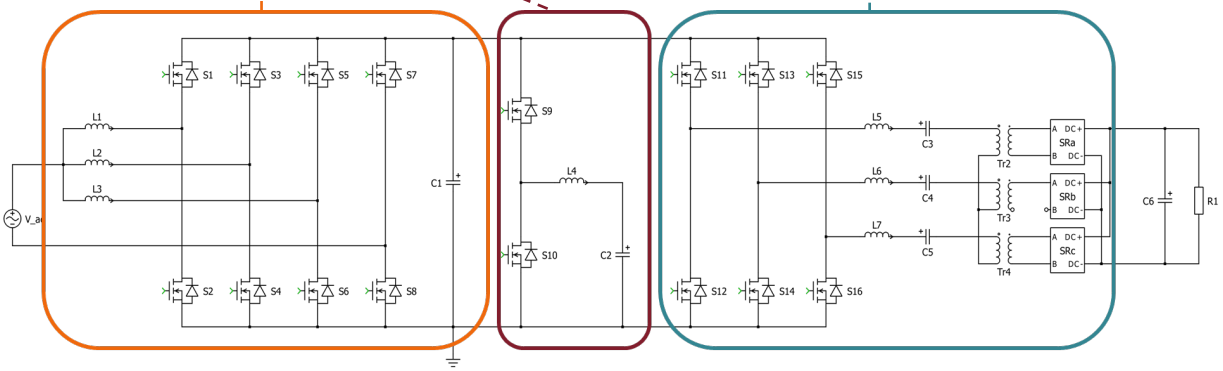


Figure 13: 12 kW AI Cloud PSU Schematic

Silicon Carbide (SiC) Solutions

Get Latest Version

Silicon Carbide (SiC)

onsemi's 650V M3S **EliteSiC** MOSFETs offers superior switching performance and lower device capacitances to achieve higher efficiency. This cutting-edge technology achieves a remarkable 97.5% peak efficiency for ORV3 PSU specifications. With best-in-class Figure-of-Merit (FoM) for high switching frequency applications, it excels in both hard-switching and soft-switching operations, achieving up to 99.6% efficiency in the PFC stage. Additionally, **onsemi's** high-performance SiC Cascode JFETs deliver high switching speeds, low on-resistance, and compatibility with existing drivers make them a compelling solution for hyperscale data centers, offering lower system costs and excellent efficiency.

650V SiC MOSFET NTBL023N065M3S

The 650V **M3S** SiC MOSFETs family is optimized for fast switching applications. Perform best with an 18V gate drive but also work well with 15V. The **TOLL** package enhances thermal & switching performance due to its Kelvin Source configuration and reduced parasitic source inductance.

Key Features:

- TOLL package with Kelvin source configuration
- Excellent FOM [= $R_{DS(on)}$ * Eoss]
- Ultra low gate charge ($Q_{G(tot)}$ = 69 nC)
- High speed switching with low capacitance (Coss = 152 pF)
- 15V to 18V gate drive
- Typ. $R_{DS(on)}$ = 23 mΩ at Vgs = 18V
- 100% avalanche tested
- Target applications: Data centers, Server power, Cloud system, Telecom

Learn more about EliteSiC MOSFET M3S family

Figure 14: 650V M3S SiC MOS Packages for AI Data Center

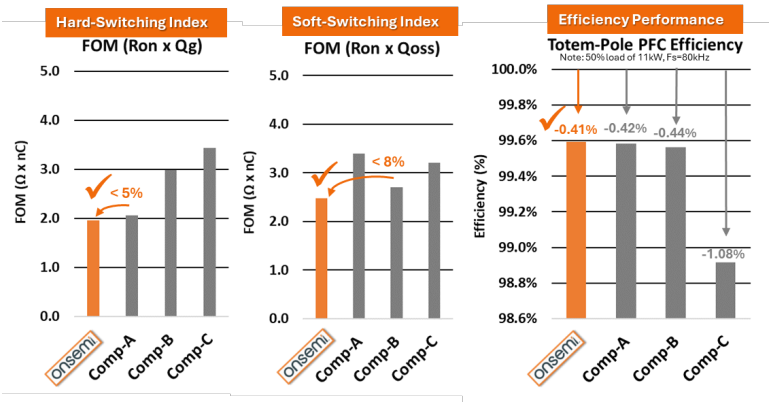


Figure 15: 650V M3S SiC MOSFET FoM Comparison

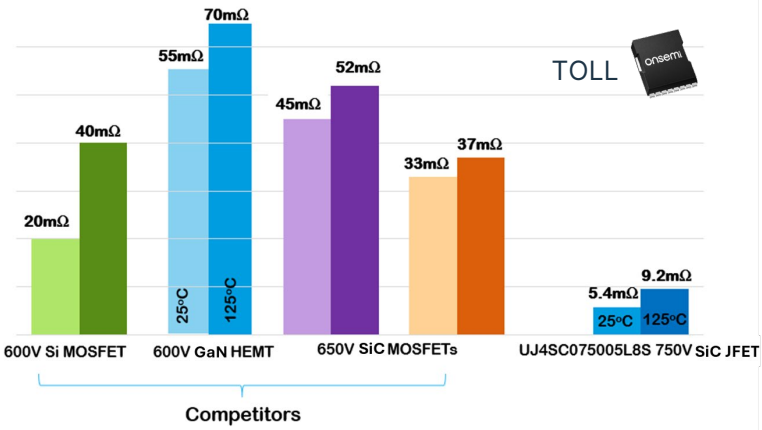


Figure 16: $R_{DS(on)}$ x Area Comparison

Download Application Note

Simulate Now

750V SiC Cascode JFETs

Achieve best balance between cost and performance for soft switching; between cost and reliability for HVDC ORing (protect against reverse input current) meanwhile keeping the same driving compatibility as SJ FET.

Key Features:

- Trench structure with reduced cell pitch
- Optimized drift region
- Reduced substrate thickness
- Industry's lowest on-resistance per unit area ($R_{DS(on)}$ x Area)
- Target applications: AI Datacenter Power Supply, EV Charging, PFC, Solar Inverters

Learn more about SiC Cascode JFET Portfolio

AI Data Center

Get Latest Version

onsemi™

Intelligent Technology. Better Future.

Register now to unlock all System Solution Guides and get additional exclusive benefits!

- Join the conversation on community forum.
- Utilize Elite Power Simulator & other developer tools.
- Watch exclusive webinars and seminars.

Open full System Solution Guide