



System Solution Guide - Preview

# AI Data Center



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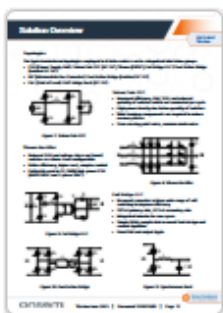
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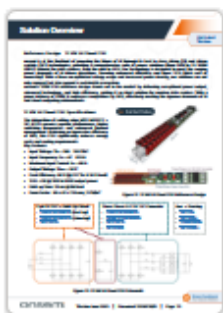
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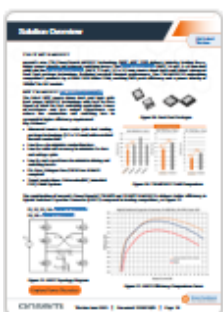
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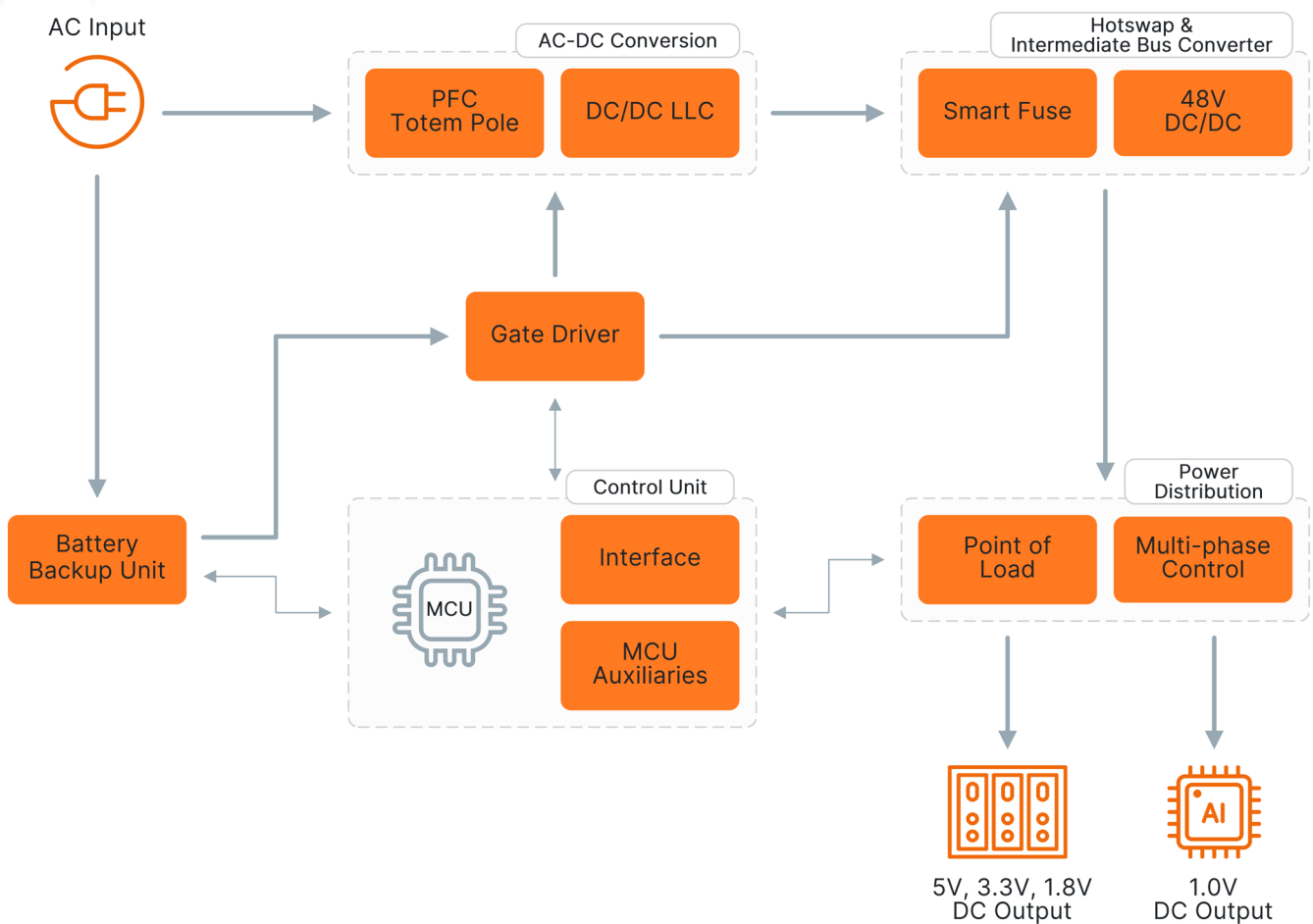
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# Block Diagram - AI Data Center

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## 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.



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## 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:  $V_{IN} = 180 - 305 \text{ VAC}$
- Input Frequency:  $F_{IN} = 47 - 63 \text{ Hz}$
- Maximum Input Current:  $I_{IN} = 68 \text{ A}$
- Output Voltage:  $V_{OUT} = 50 \text{ V}$
- Peak Efficiency: 98 % (@ 277  $V_{IN}$  & 50 % load)
- THD:  $\leq 5\%$  @ 30% to 100% output power
- Hold-up Time: 20 ms @ full load
- Form Factor: 80 x 42 x 750 mm, 75 W/in<sup>3</sup>

Contact Sales

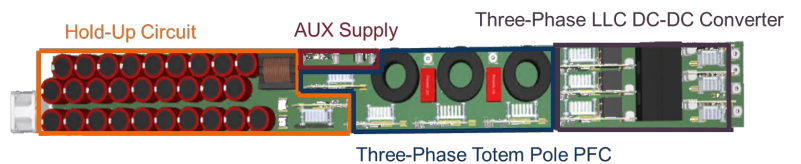
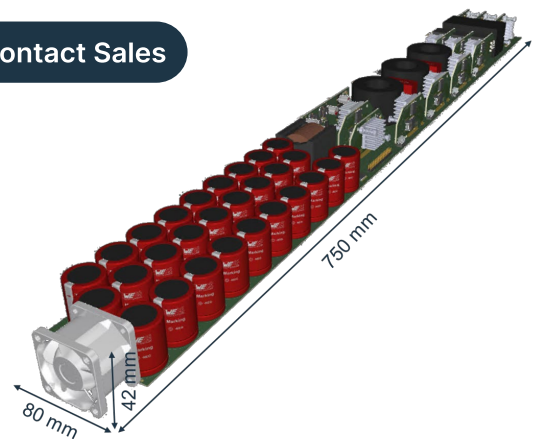


Figure 12: 12 kW AI Cloud PSU Reference Design

### 3-ph TP PFC + Hold-Up Circuit

- [UJ4SC075018L8S](#) (fast leg)
- [UJ4SC075005L8S](#) (slow leg)
- [NCP51752](#)

### Three-Phase LLC DC-DC Converter

- [UJ4SC075008L8S](#)
- [NTMF5CH1D4N08X](#)
- [NCP51752](#)
- [NCP4306](#)

### Aux. + Sensing

- [NCP781](#)
- [NCP1060](#)
- [FAN65004B](#)
- [NCS20071](#)

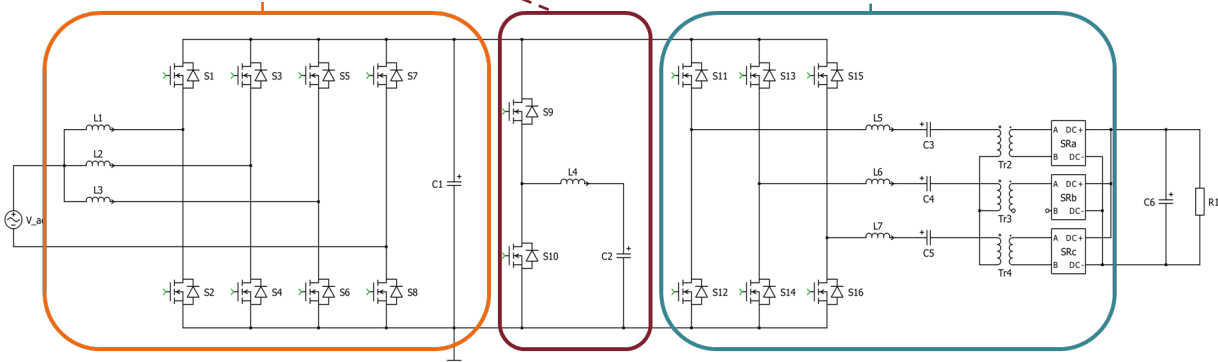


Figure 13: 12 kW AI Cloud PSU Schematic

# Silicon Carbide (SiC) Solutions

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## 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 [ =  $R_{DS(on)} \cdot E_{oss}$  ]
- Ultra low gate charge ( $Q_{G(tot)} = 69$  nC)
- High speed switching with low capacitance ( $C_{oss} = 152$  pF)
- 15V to 18V gate drive
- Typ.  $R_{DS(on)} = 23$  m $\Omega$  at  $V_{gs} = 18$  V
- 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

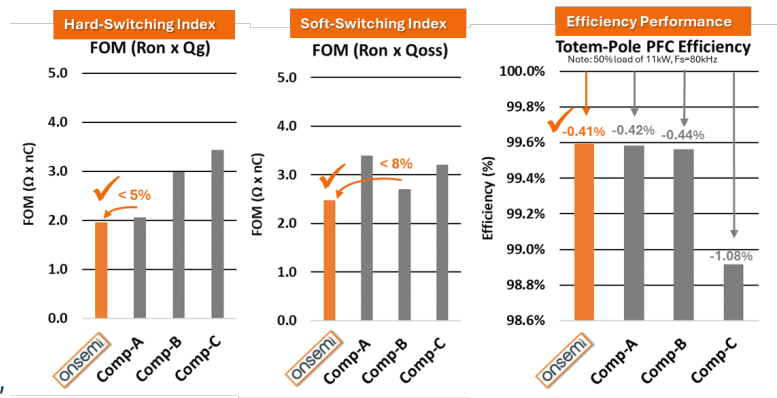


Figure 15: 650V M3S SiC MOSFET FoM Comparison

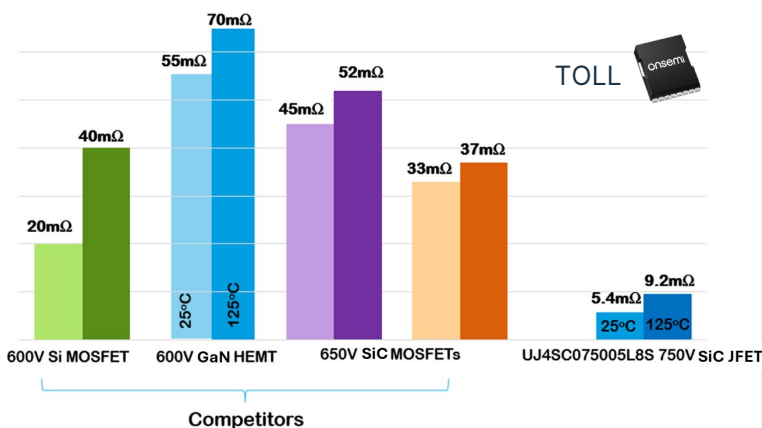


Figure 16:  $R_{DS(on)} \times \text{Area}$  Comparison

## 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 ( $R_{DS(on)} \times \text{Area}$ )
- Target applications: AI Datacenter Power Supply, EV Charging, PFC, Solar Inverters

Learn more about [SiC Cascode JFET Portfolio](#)




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