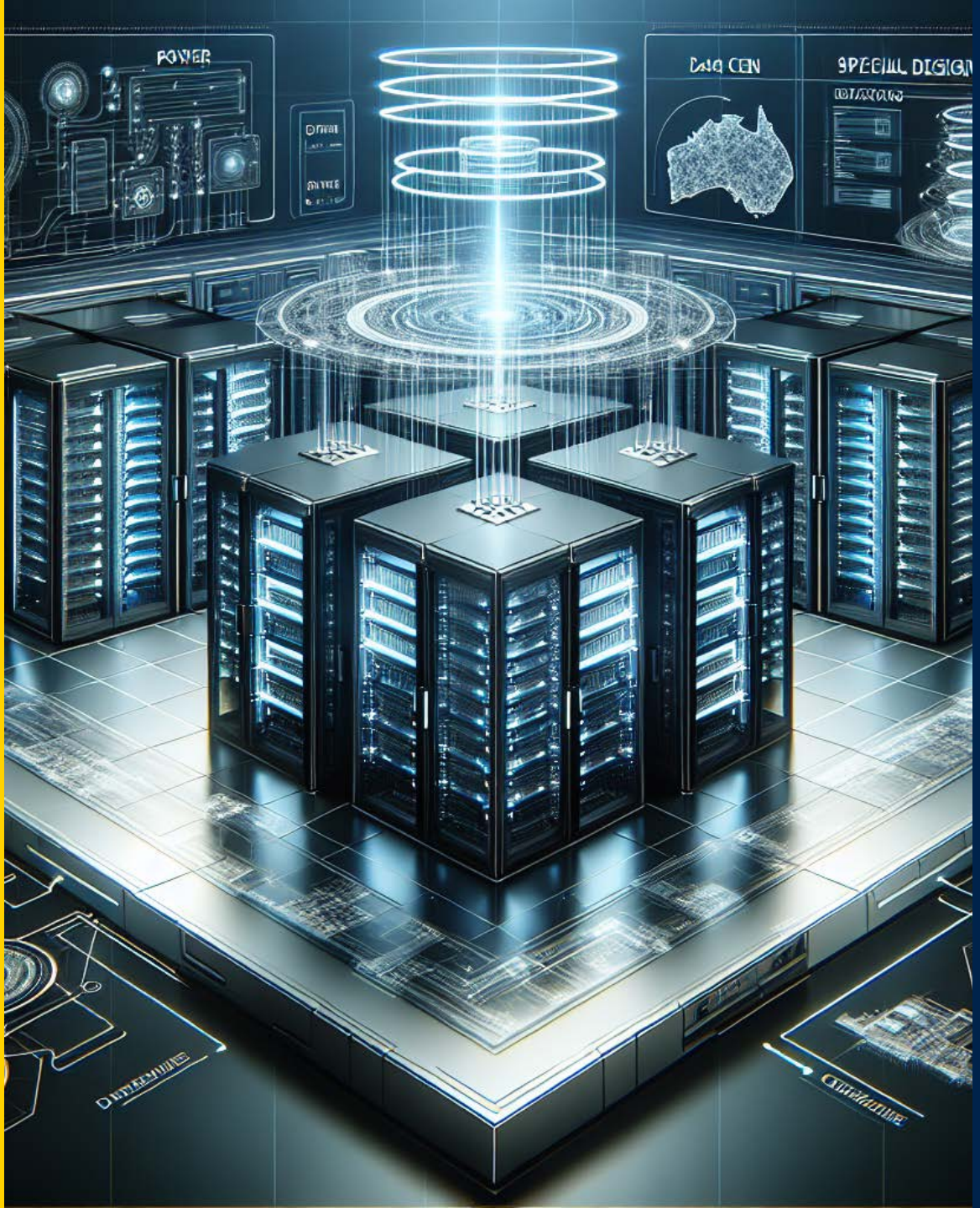


Comprehensive power delivery solution for modern AI data centers

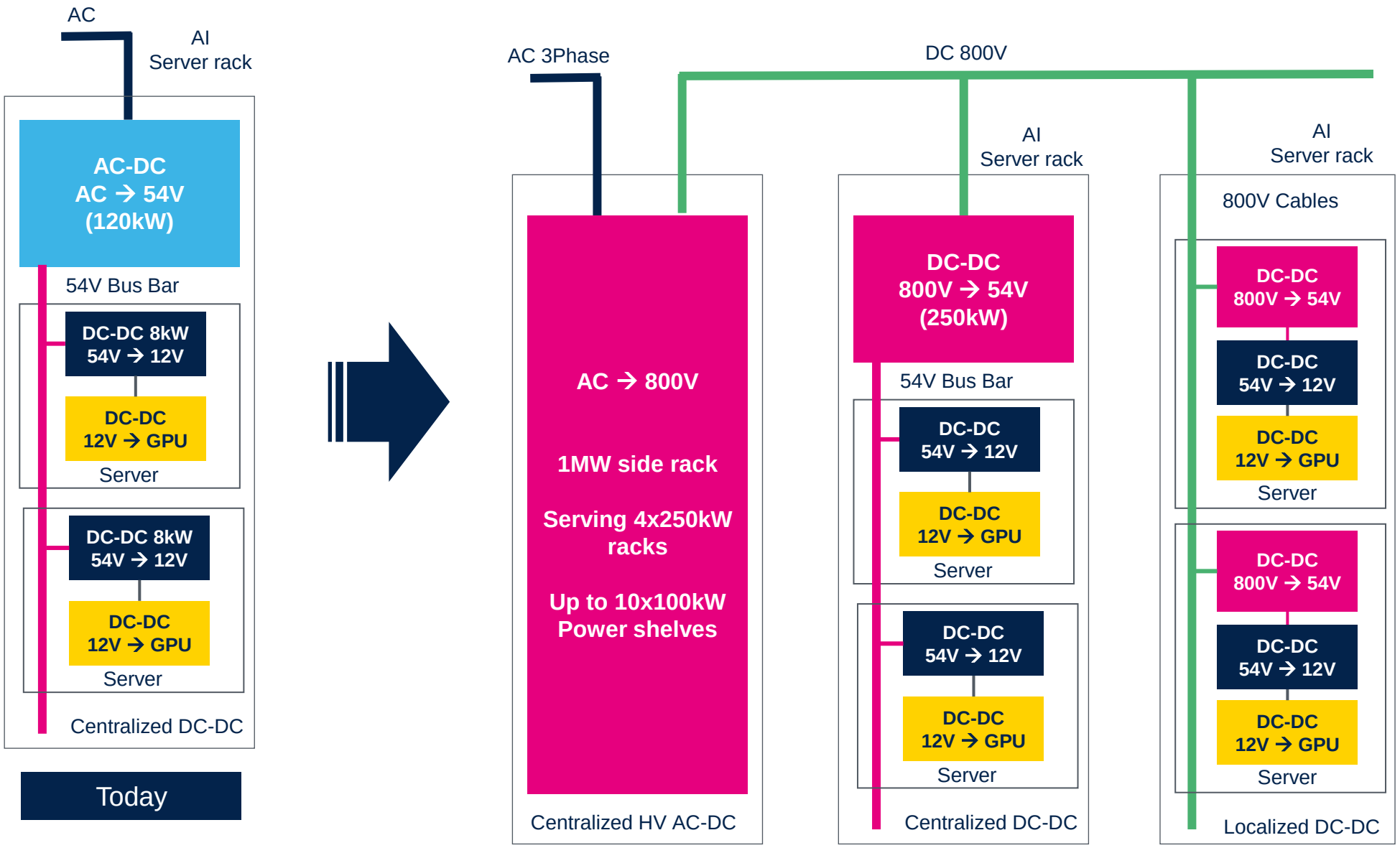
Paolo Sandri, Gianni Vitale

STMicroelectronics

Comprehensive Power Delivery for Modern Data Centers

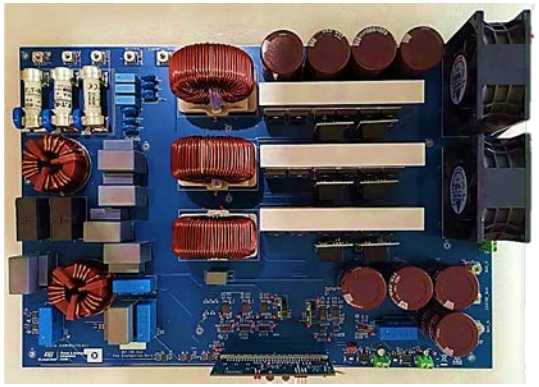
1. Modern AI Data Center Infrastructure
2. ST Power Deliver from Grid to POL
3. 30kW 3-phase Vienna rectifier
4. 30kW 3-phase LLC converter
5. 1kW GaN-based converter
6. 32 phase xPU VR with dual-phase power block

800V rack power delivery



Comprehensive ecosystem
From three phase AC to xPU POL

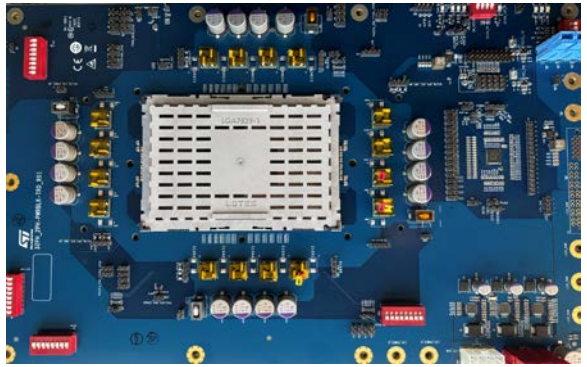
3 phase AC to 400V/800V → **400V/800V to 54V** → **IBC 54V to 12V** → **POL VR 12V to xPU**



30kW 3-phase Vienna rectifier

30kW 3-phase LLC converter

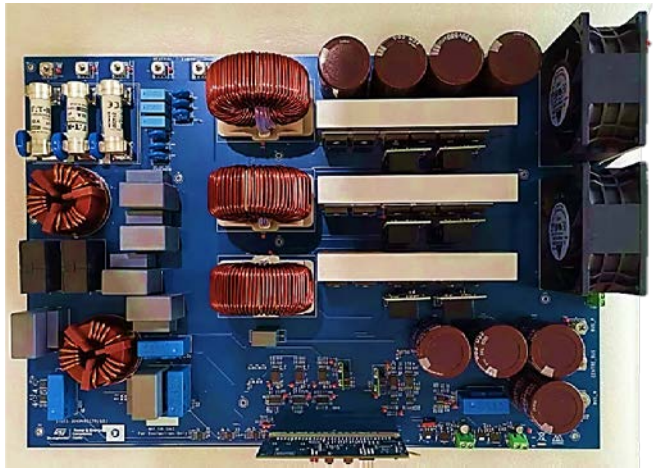
1kW GaN-based converter

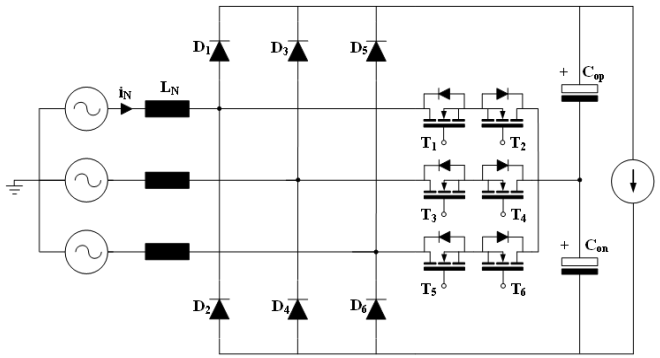


32 phase xPU VR with dual-phase power block

30 kW three-phase Vienna rectifier

30 kW three-phase Vienna rectifier





Application key specification

1. Input AC voltage: three-phase 345 VAC up to 460 VAC with 47 Hz up to 63 Hz
2. Maximum input current: 55 ARMS
3. DC Vout 800 VDC, rated output power **30 kW**, switching frequency 70 kHz
4. Peak efficiency **>98.7%**
5. 0.99 power factor with lower than 5% THD @ full load operation
6. STM32G474: high performance 32-bit MCU

Key products

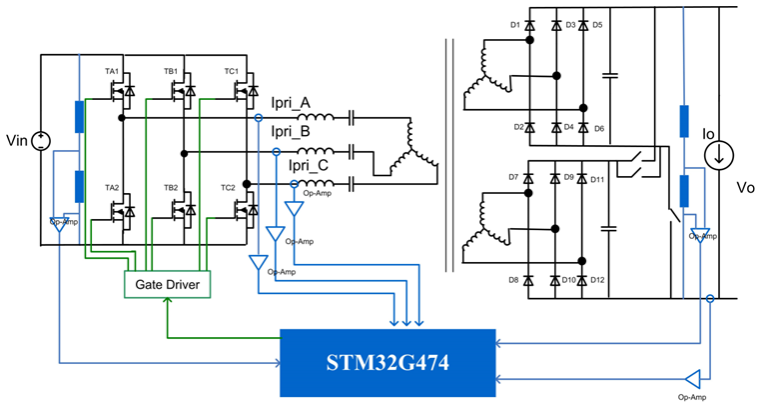
1. MCU: STM32G474RET3
2. SiC MOSFET: SCT018W65G3-4AG
3. SiC diode: STPSC40H12C
4. Gate driver: STGAP2SICS
5. Schottky diodes: STTH1L06A, STPS1150A, STPS2H100A, STPS2L60A
6. GPA: LD29080S33R, LD29080DT50R, TSV912IDT, TSV912IDT

Key benefits

- Solution based on SiC device; higher efficiency achieved
- Very low THD (total harmonic distortion)
- **Higher reliability**
- Low design complexity

30 kW three-phase LLC converter

30 kW three-phase LLC converter



Application key specification

1. Rated output power: 30 kW, switching frequency 100-300 kHz
2. DC input voltage: 650 VDC – 850 VDC
3. DC output: 200 VDC – 1000 VDC
4. Peak efficiency >98%
5. STM32G474: high performance 32-bit MCU

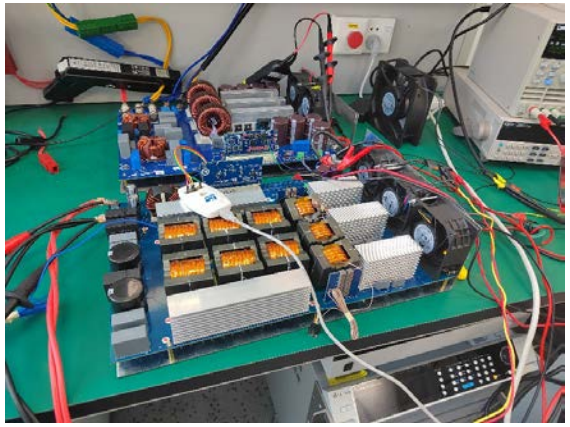
Key products

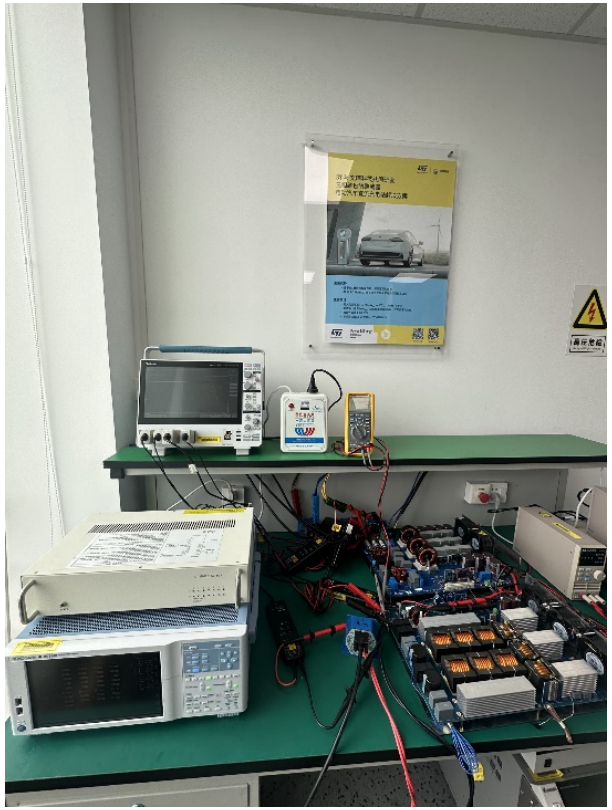
1. MCU: STM32G474VET6,
2. SiC MOSFET: SCT025W120G3-4AG
3. Ultrafast diode: STTH60RQ06W
4. ASP product: STGAP2SICS, L6565
5. Schottky diodes: STTH1L06A, STPS1150A, STPS2H100A, STPS2L60A
6. GPA: LM393DT, LD29080DT50R, LD29080DT33R, TSV9121DT

Key benefits

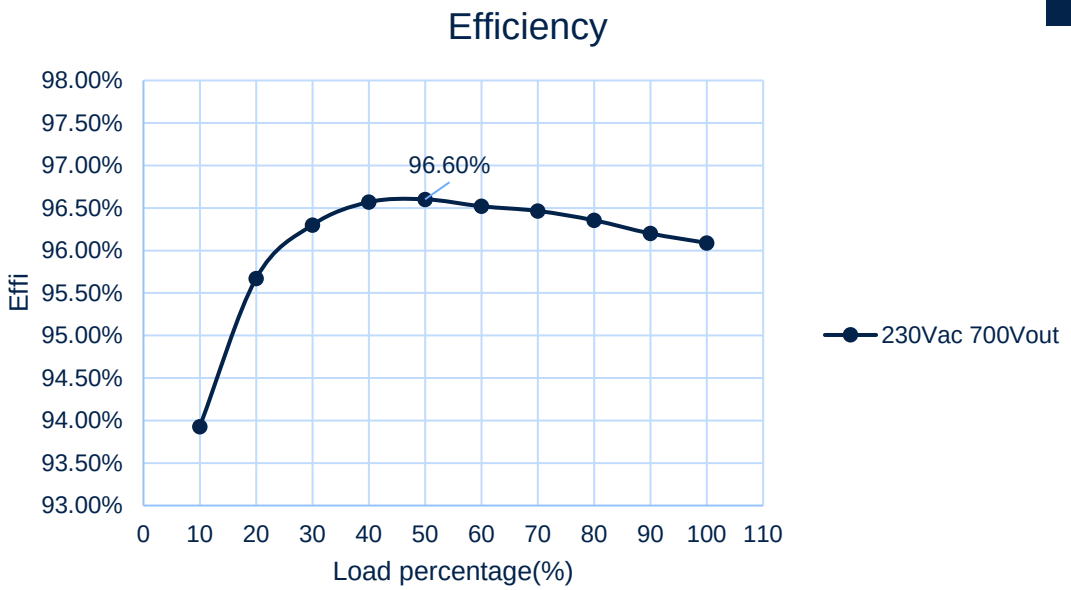
1. Higher efficiency with **1200V** SiC device and high switching frequency
2. Less SiC MOSFET to achieve higher power with single LLC converter
3. Wide range and high output voltage

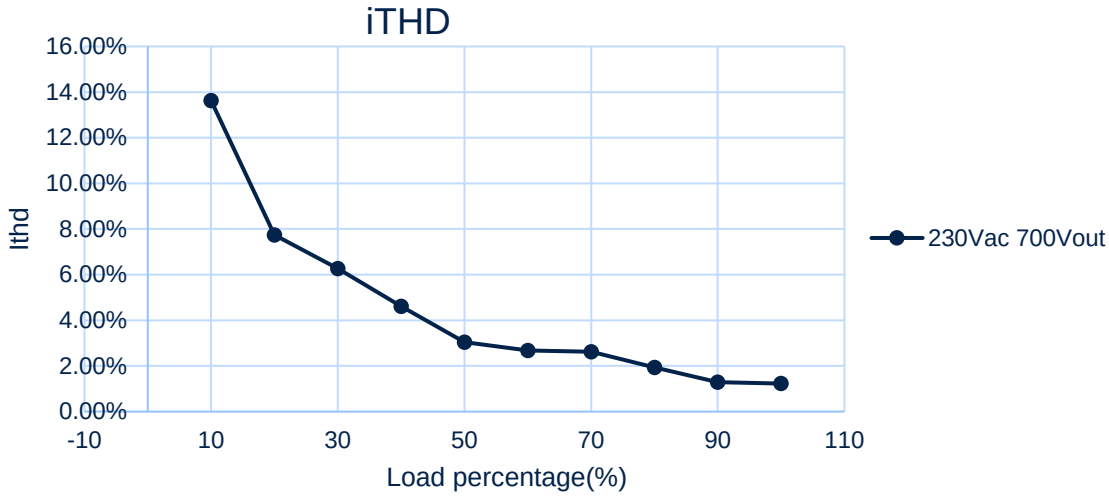
ST 30 kW total solution



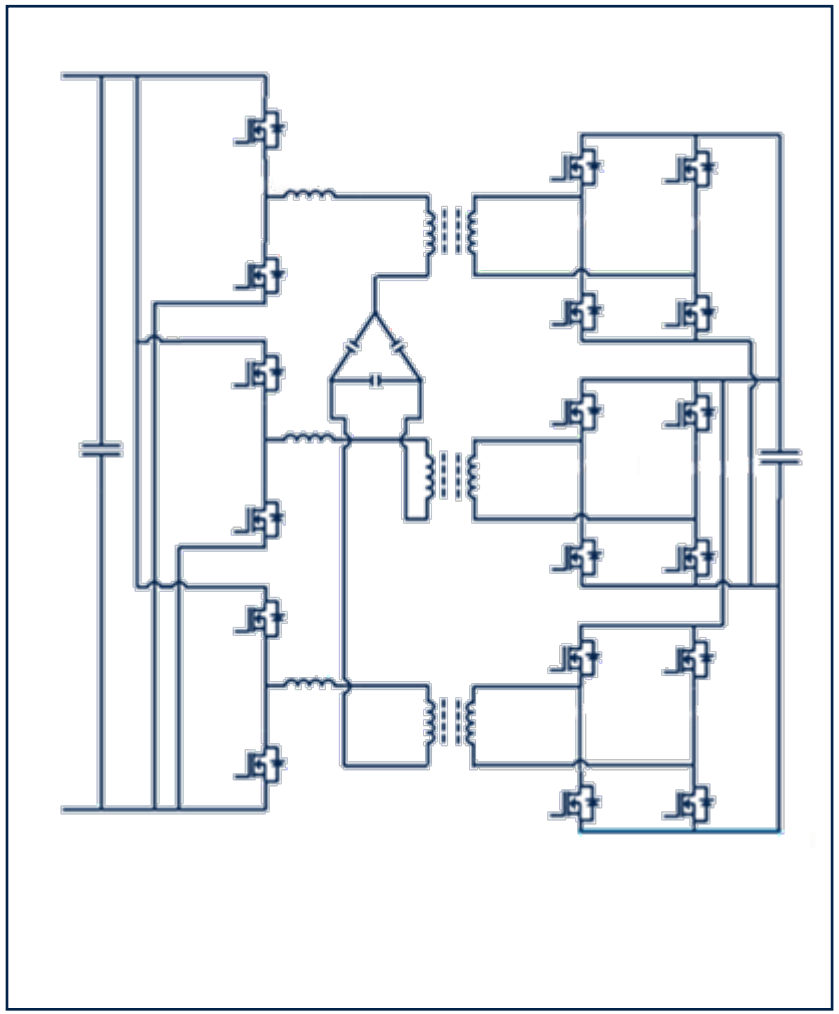


96.6% peak and 96% high efficiency in full load





800V to 54V three-phase LLC converter



Application key specification

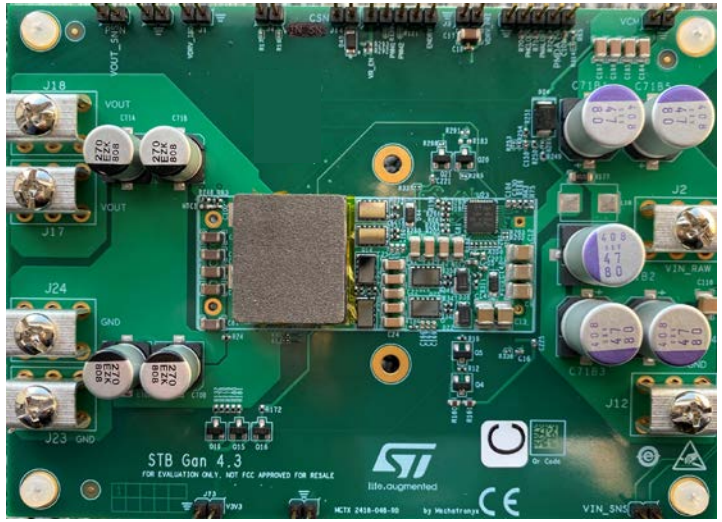
1. Rated output power: **10 kW**, switching frequency **100-300 kHz**
2. DC input voltage: 750V-850 VDC
3. DC output: 54 VDC
4. Peak efficiency: **>98%**
5. STM32G474: High performance 32-bit MCU

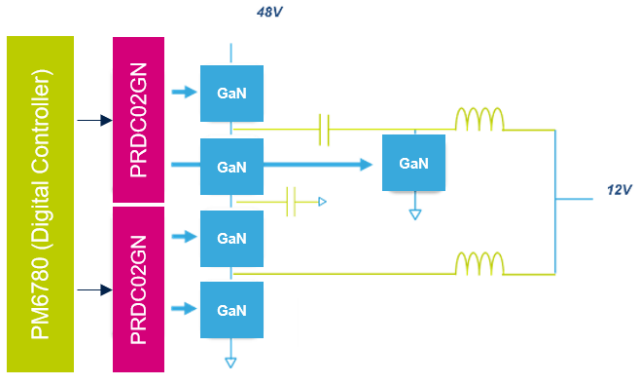
Key benefits

1. Higher efficiency with **1200V SiC** and high switching frequency
2. Less SiC MOSFET for higher power single LLC converter
3. High power density

1kW GaN-based converter

1kW GaN-based converter





Application key specification

1. Intermediate bus conversion
2. High efficiency, high density regulated DC-DC in 1/8th brick FF
3. Frequency up to **800kHz** and **>98%** efficiency
4. 1kW cell scalable up to **8kW** TDP
5. Server PDB (Power Distribution Board)
6. Redundant interleaved power delivery

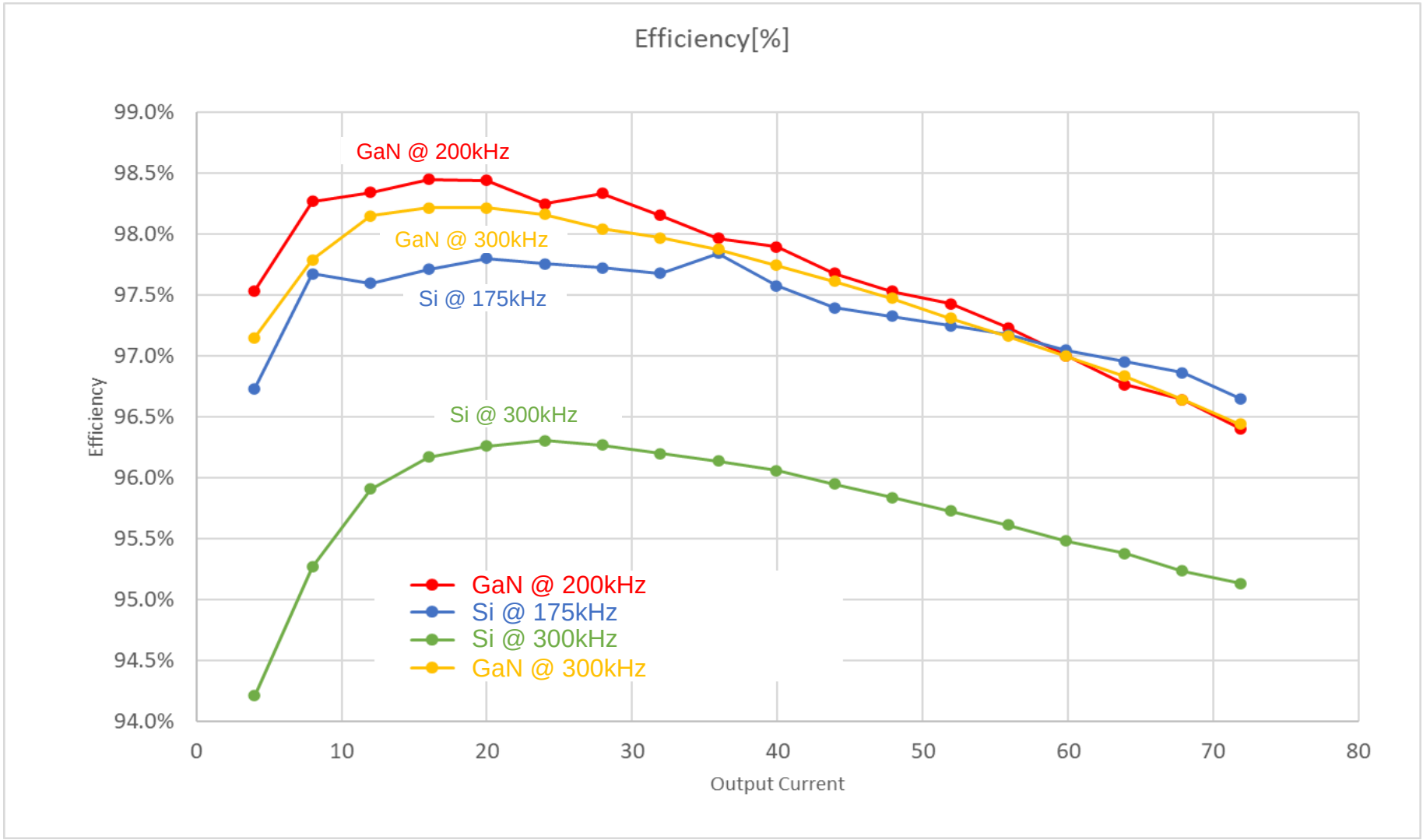
Key products

1. Fully digital multiphase controller: PM6780
2. STPRDC02GN dual half bridge smart driver for GaN
3. 48V, 28A power eFuse: STEF48H28
4. High frequency optimized magnetic from ITG

Key benefits

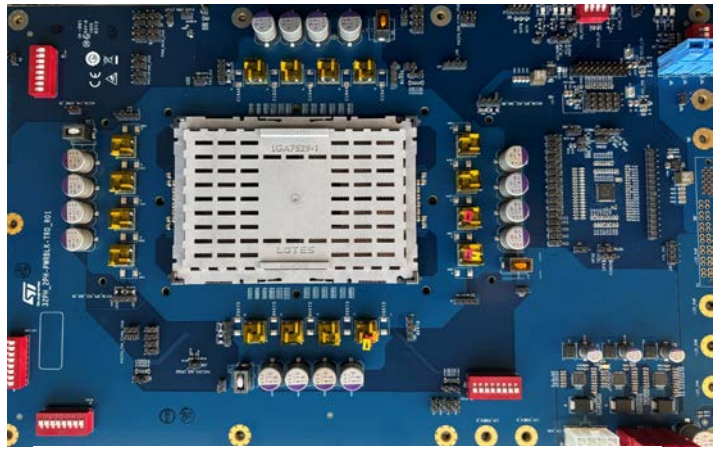
1. Higher efficiency and high density based on 100V GaN
2. Power density more than **500W/inch²**
3. High switching frequency 800kHz
4. Peak efficiency **>98%** with **flat** efficiency curve

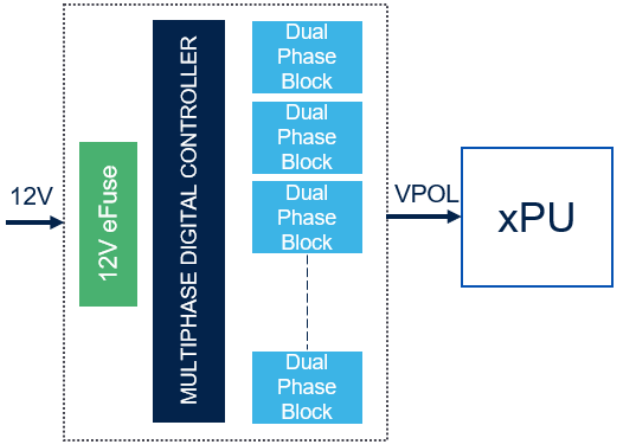
Efficiency comparison Si MOSFET vs GaN



32 phase xPU VR with dual-phase power block

32 phase xPU VR with dual-phase power block





Application key specification

1. Fully digital controller with 100MHz ARM Cortex uC
2. Real fully digital **STVCoT** control loop – **TLVR** supported
3. Programmable N+M phase: 16+0/8+8 --- 12+0/6+6
4. Intel VR1x.Cloud, AMD SVI3.0, AVS
5. Traditional/TLVR multiphase with **Secure PMBus™** (rev1.5)
6. Full set of protection (OV, UV, OP, OT, OC, per-phase OC)

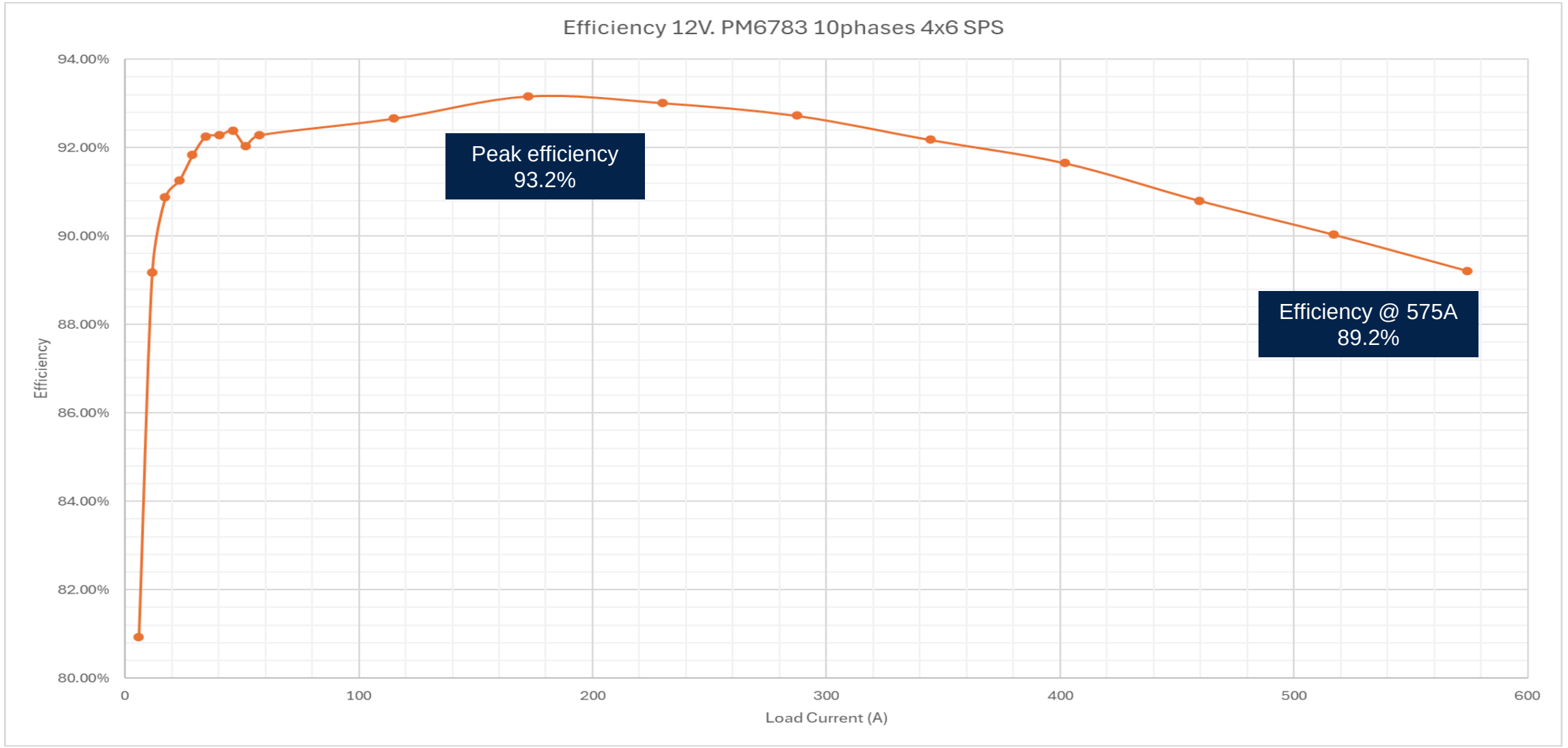
Key products

1. Fully digital multiphase controller for Intel, AMD and AVS: PM6784
2. Dual phase power block with 4x6 90A SPS PM7091A
3. 12V, 60A power eFuse: STEF12H60

Key benefits

1. Flat efficiency with a peak of **93.2%**
2. 80A TDC, 140A peak **Dual Phase Power Block**
3. Firmware and configuration file upgradeable with configurable telemetry
4. Life-time counter and accurate black box recorder
5. Power stage and Lout Soldering Detection Algorithm (TLVR compatible)
6. Limp mode operations

Efficiency at SPS with DPM enabled



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