



Power transistor devices for AI servers



Data center power supply unit trends

Well-defined power ratings for PSU (1-3, 5.5, and 12 kW); trend from single-phase to three-phase source configuration

PSU manufacturers are transitioning toward 48 V and 400 V architectures, with growing use of 400 V SiC and GaN-based designs

The mainstream PSUs in HPC*, hyperscale, and large enterprise becomes power shelf architecture, aiming to increase power efficiency and scalability

NVIDIA sets new requirements that made 120 kW PSU racks a reality and effectively made liquid cooling a mandatory standard for thermal management

*HPC = High performance computing

Source: STMicroelectronics, YOLE - Power electronics for Data centers 2025

Data center infrastructure trends

The explosion in AI training and inference workloads is driving massive increases in computing, power, and infrastructure needs.

*BBU = Battery back unit

**SMR = Small modular reactor

BBU* would increase the demand for lithium-ion batteries and low-voltage power switches used in the DC-DC converter

Getting energy production closer to the data center facility accelerates growth of renewable energy (wind, solar, battery storage, natural gas, and SMR**)

With disruptive AI data centers demanding extremely high efficiency, liquid cooling is becoming a requirement rather than optional.

Products in applications

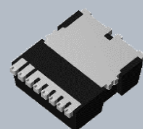
PFC >3 kW block scheme

Topology: 3-ch interleaved totem pole PFC
Control strategy: hysteresis current control

High Frequency Leg

Technology	SiC
Package	TO-LL
PN: SCT040TO65G3	40 mΩ
# of parallel devices	2

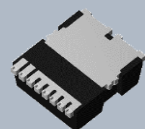
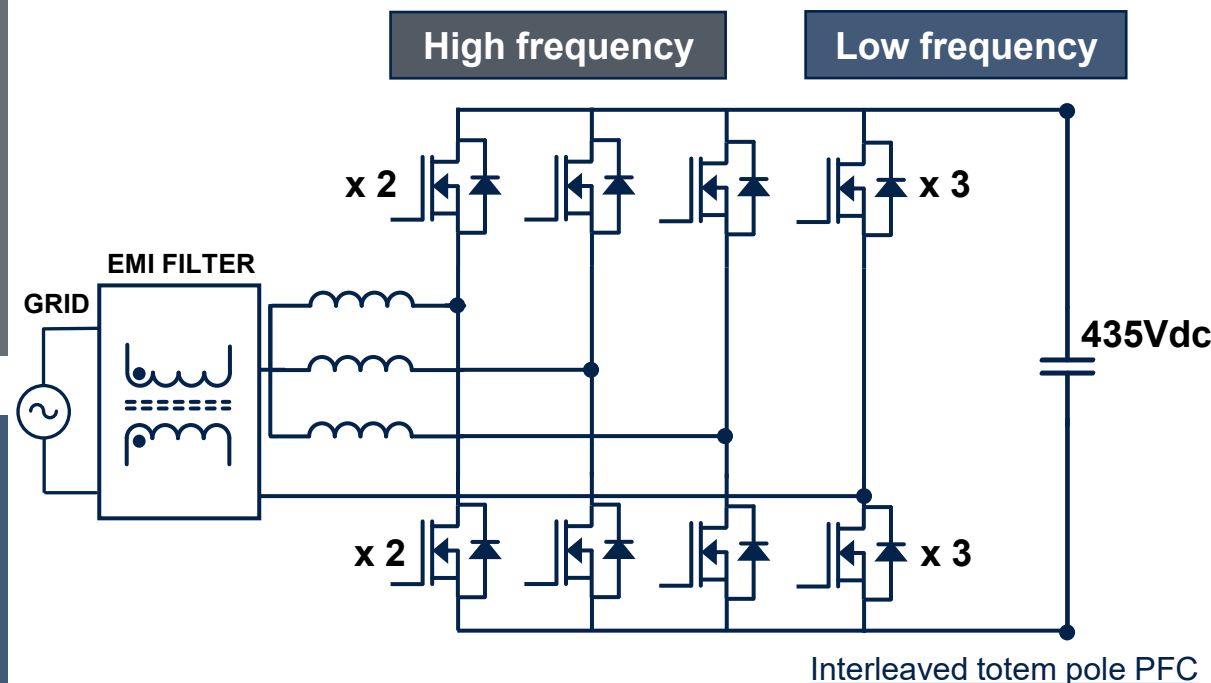
TO-LL



Low Frequency Leg

Technology	SiC
Package	TO-LL
PN: SCT014TO65G3	13.5 mΩ
# of parallel devices	3

TO-LL



- **Gate driver:** 4x STGAP2D
- **MCU:** 1x STM32G474QET6
(controlling also baby boost circuit)

Baby boost option block scheme

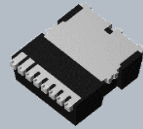
For hold-up time requirement

Bypass switches

Topology: **3-ch interleaved boost**
Control strategy: **fixed frequency CCM**

Technology	SiC
Package	TO-LL
PN: SCT014TO65G3	13.5 mΩ
# of parallel devices	4/3

TO-LL



High frequency switches

Technology	GaN
Package	PF 8x8
PN: SGT080R70ILB	80 mΩ

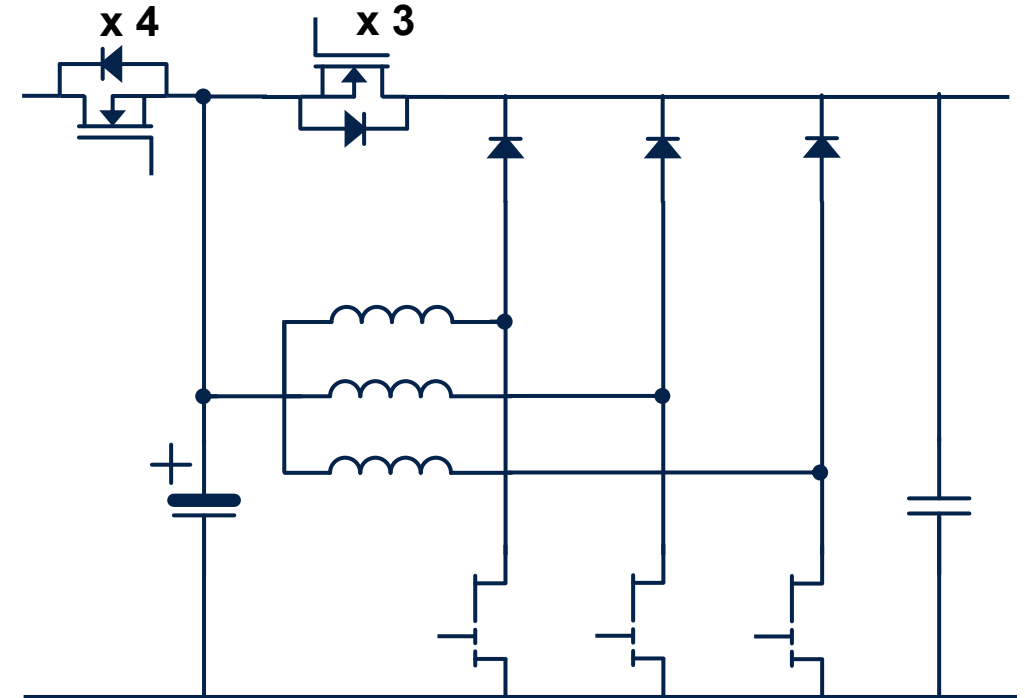
PowerFLAT 8x8



Rectifier diodes

Technology	SiC
Package	PF 8x8
PN: STPSC10H065DLF	10 A

PowerFLAT 8x8



- Gate driver: 1x STGAP2D, 3x STGAP2GS

3-phase PFC solution

Centralized AC-DC conversion

HVDC bus facilitates new energies integration
(solar, wind, H2 fuel-cell, energy storage)

PFC & DC-DC converters: 16 kW

SCT040W65G3-4	650 V, 45 mΩ
SCT070W120G3-4	1200 V, 63 mΩ



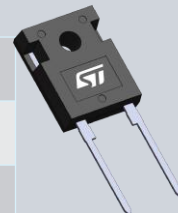
PFC & DC-DC converters: 26-30 kW

SCT027W65G3-4AG	650 V, 29 mΩ
SCT040W120G3-4	1200 V, 40 mΩ



PFC & DC-DC converters: SiC diodes

STPSC20G12WL	20 A
STPSC30G12WL	30 A
STPSC40G12WL	40 A



SiC
MOSFETs

SiC
MOSFETs

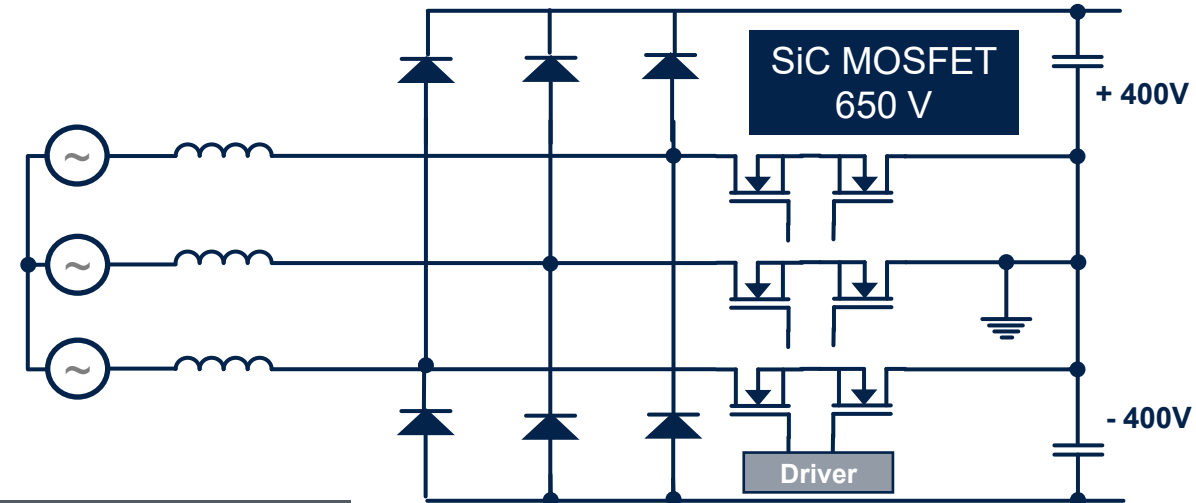
1200 V
SiC diodes



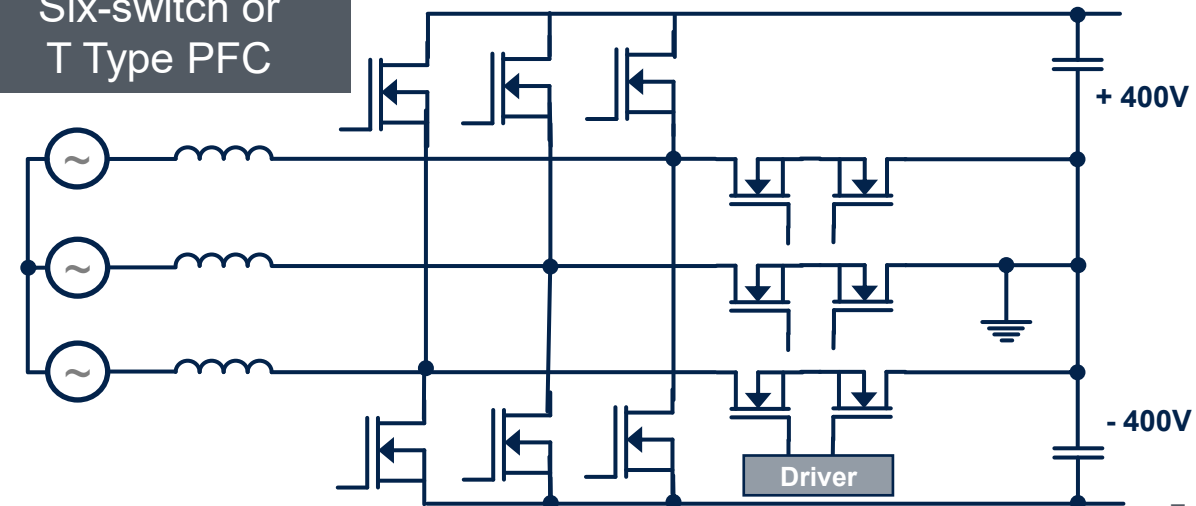
Vienna PFC

SiC diode
1200 V

SiC MOSFET
650 V



Six-switch or
T Type PFC



DC-DC stage LLC block scheme

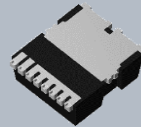
Topology: 3-Ch Interleaved LLC

Control strategy: VM with freq. modulation*

High
Voltage
Side

Technology	SiC
Package	TO-LL
PN: SCT027TO65G3	29 mΩ
# of parallel devices	2

TO-LL



Low
Voltage
Side

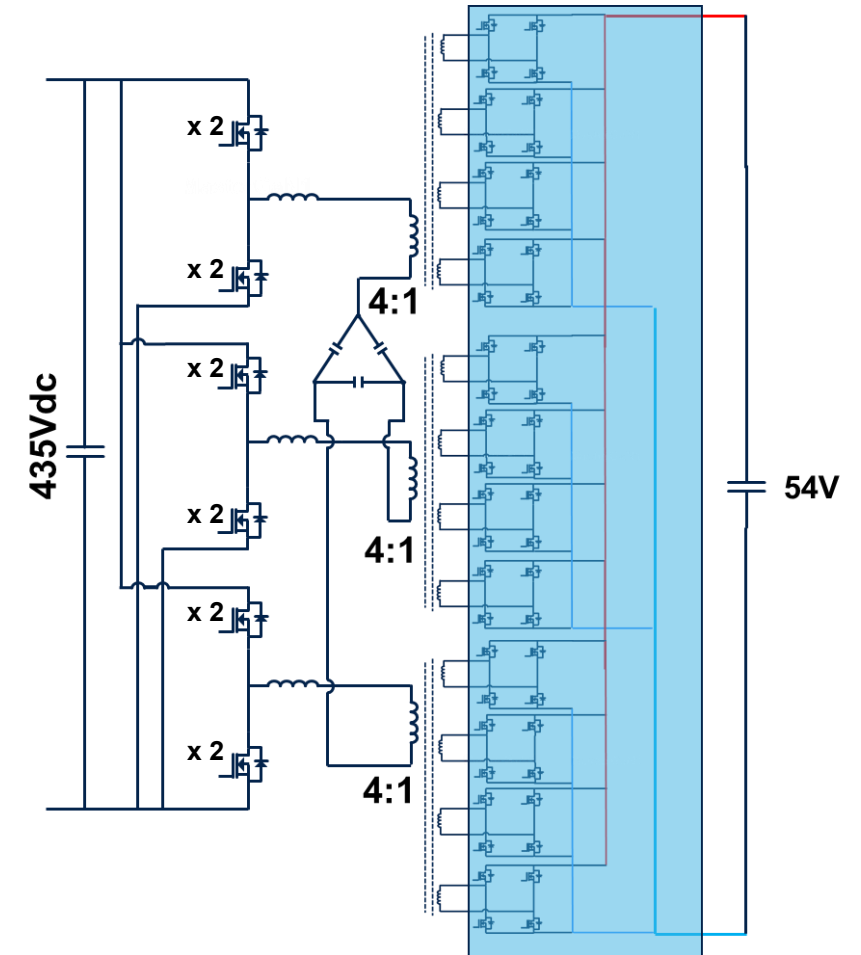
Technology	LV F8
Package	PF5x6
PN: STL160N10F8	3.2 mΩ
# of parallel devices	1

PowerFLAT 5x6



LLC resonant

Synch rect

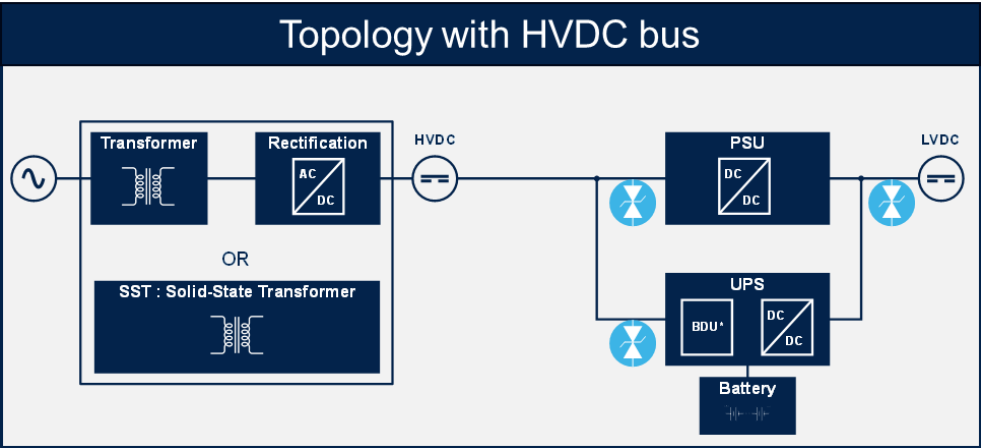


- Gate driver: 3x STGAP2D, 24x L6498
- MCU: 1x STM32G474QET6

DC-DC protection 48 V power rail

EN 55024 defines the immunity test requirements for information technology equipment

EN55024:2010
IEC 61000-4-2: 4kV contact, 8kV air
IEC 61000-4-5: 1kV, line / GND → for Ethernet
IEC 61000-4-5: 1kV/500A line / line for AC input
IEC 61000-4-5: 2kV/166A line / earth for AC input
IEC 61000-4-5: 0.5kV/42A line to earth for DC input



600-5000 W TVS protection

High surge capability in SMC package, even at high temperature.

	I _{RM} max at V _{RM}			V _{BR} at I _{BR}				10/1000 μs			8/20 μs			αT
								V _{CL}	I _{PP}	R _D	V _{CL}	I _{PP}	R _D	
	25°C	85°C		Min.	Typ.	Max.		Max.		Max.	Max.	Max.	Max.	Max.
	μA	μA	V	V	V	V	mA	V	A	mΩ	V	A	mΩ	10 ⁻⁴ /°C
SMC50J58A/CA	0.2	1	58	64.6	68	71.4	1	93.6	53	419	121	381	130	10.4

Longevity

Designed for integration into your system with a service life of at least 10 years.

Robustness

The only solution rated at 3700 W with Tamb = 175°C

BOM reduction

Replaces two 3 kW SMC devices

Compactness

5 kW capability in a standard SMC footprint (26 mm²)

Reliability

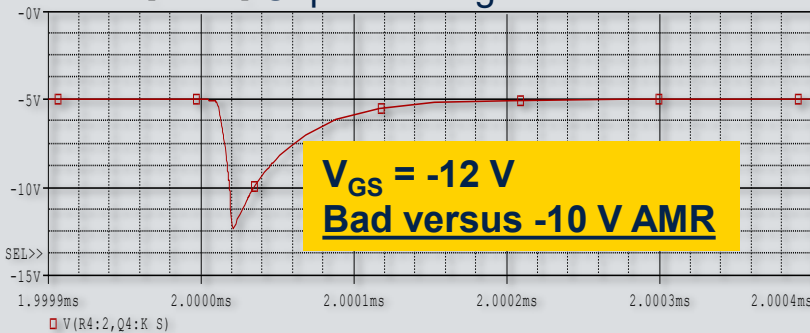
Manufactured on automotive lines, with ST qualification according to automotive criteria

SiC MOSFET protection

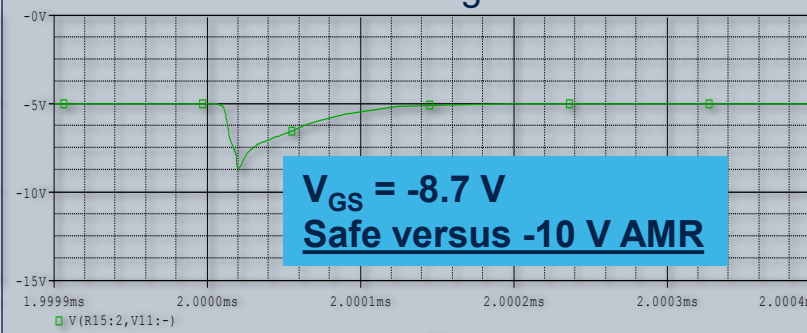
Safe operation even at high frequency, by clamping the voltage at safe levels ($\ll$ AMR) during spikes and transients.

Overvoltage/undervoltage can be applied on MOSFET due to parasitic inductance on source pin, or high dV/dt on a H bridge

Unprotected gate

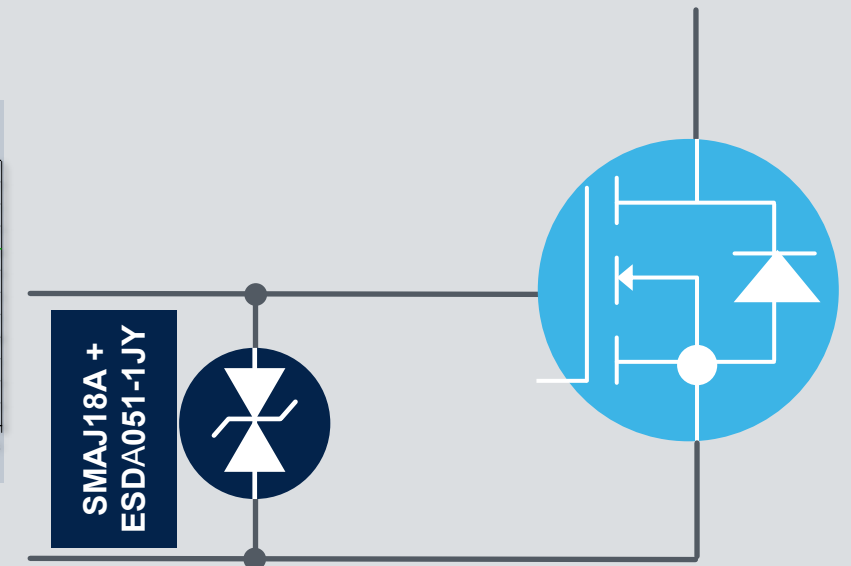


Protected gate



SiC MOSFET V_{GS} - H bridge topology

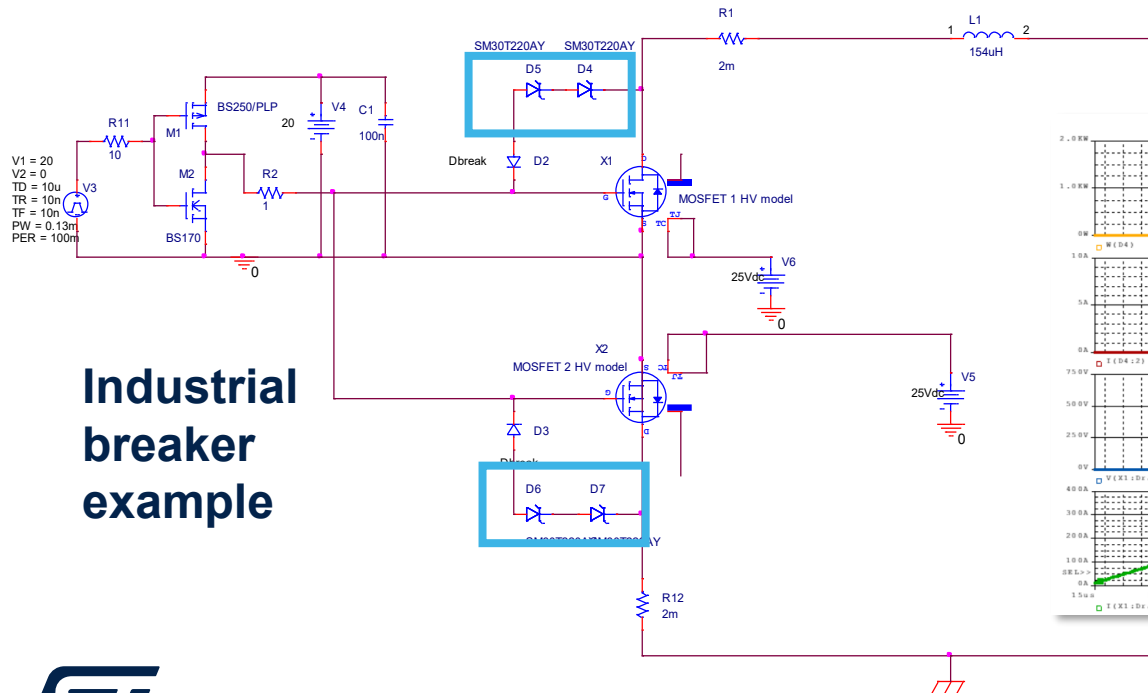
SMAJ18A + ESDA051-1JY (antiseriess connection)



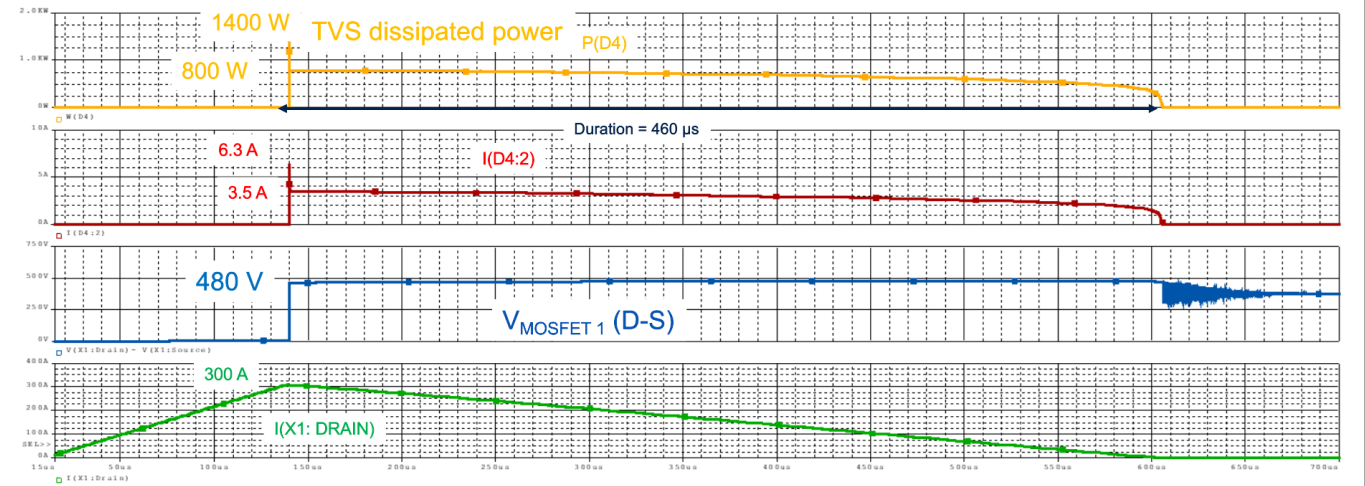
Protection as a MOSFET companion

MOSFET + parasitic inductance requires a protection design

- MOSFETs are opening due to short-circuit detection
- Overvoltage is applied between drain and source due to line inductance
- **Overvoltage is limited** below 500 V thanks to **TVS clamping**.

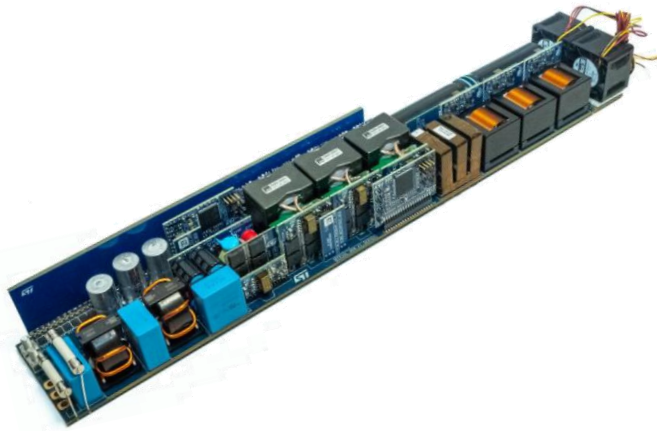


TVS MOSFET clamping protection



Reference designs

8.4 kW ORv3 AI server PSU in development



Key application features:

- V_{in} = 180 to 277 Vac
- V_{out} = 54 Vdc
- Maximum output power: 8.4 kW at 54 Vac
- 3-ch Interleaved LLC resonant converter with synch. rect.
- 3-ch interleaved totem pole
- Hold-up time extension boost circuit: 3-ch interleaved boost converter
- Power factor: > 0.99 @ 100% load, > 0.92 @ 10% load
- THD: < 5% @ 30-100% load, < 10% @ 10-30% load, < 15% @ 5-10% load
- Size = 73.5 x 450 x 40 mm

Key products

- **MCU control board:** 2x STM32G474
- **PFC:** 12x SCT040TO65G3, 6x SCT014TO65G3, 4x STGAP2D
- **Baby-boost:** 7x SCT014TO65G3, 3x SGT080R70ILB, 3x STPSC10H065DLF, 1x STGAP2D, 3x STGAP2GS
- **LLC:** 12x SCT027TO65G3, 48x STL160N10F8, 3x STGAP2D, 24x L6498
- **Aux. SMPS:** VIPERGAN50W, L6983N50/33QTR, ST1S12GR, L6983I

Benefits

- PFC: peak efficiency target: $\geq 98\%$ @ 230, 240, 277 Vac, Min. efficiency: >96.5 in 30% - 100% load, including fan
- Cluster of IPs scalable to 10-12 kW power, unique combination of SiC, GaN, & Si power technologies
- Adaptive PFC and LLC control for an unprecedented efficiency: 98% peak efficiency (target)
- Thermal management designed with simulation of internal air flow and dedicated mechanical study

AI server PSU

ORv3 5.5 kW power supply in development



Key application features:

- Fully digital AC-DC power supply
- Input AC voltage: 180 VAC up to 305 VAC
- Input AC frequency: 47-63 Hz
- DC output voltage: 50 VDC
- Peak efficiency: 97.5% @ 230 VAC
- Power Factor > 0.98 @ 100% load
- iTHD < 5% @ 100% load
- Outline dimension: 73.5 x 640 x 40 mm
- Power density up to 48 W/inch³
- Peak inrush current < 30 A

Key products

PFC:

- SCT040TO65G3 x4 (SiC FET)
- STGAP2SICS x4 (SiC FET driver)
- STO60N030M9 x4 (Si FET)
- STGAP2D x2 (Si FET driver)
- STM32G4 x1 (32-bit MCU)
- STPM32 (metering solution)

LLC:

- ST8L65N050DM9 x6 (Si FET)
- STGAP2D x3 (Si FET driver)
- STL120N10F8 x 24 (Si FET)
- STM32G4 x1 (32-bit MCU)
- STSAFE-A110 (security solution)

Aux power:

- VIPERP4 x1

Benefits

- Peak efficiency > 97.5%
- ORv3 compatible

(Including fan power loss)

3 kW standard server PSU solution



Key application features:

- Fully digital AC-DC power supply
- Input AC voltage: 90-264 V
- Input AC frequency: 47-63 Hz
- DC output voltage: 53.5 VDC
- Peak efficiency: 96.3%
- Power factor > 0.98 @ 100% load
- iTHD < 5% @ 100% load
- Hold up time: 10 ms
- Power density up to 40 W/inch³
- Peak inrush current <30 A

Key products

- **PFC:** SCTW35N65G2V (SiC MOSFET), STY139N65M5 (SJ MOSFET), STGAP2D (galvanic insulated gate driver), STM32G4 (32-bit MCU)
- **LLC:** STW70N65DM6 (SJ MOSFET), STGAP2HS (galvanic insulated gate driver), STL130N8F7 (SR MOSFET), STM32G4 (32-bit MCU)
- **Aux. power:** VIPER38LD (Converter for aux. PS)

Benefits

- Over 96% Peak efficiency
- 1U form factor
- Power density up to 40 W/inch³

Standard server PSU

2 kW 3-ch interleaved ZVS resonant totem pole PFC



Key application features:

- V_{in} = 90 to 253 Vac
- V_{out} = 390 Vdc
- Maximum output power: 2 kW at 230 Vac, 1 kW at 115 Vac
- 3-ch interleaving with phase shedding
- Hysteresis current control
- Cycle-by-cycle regulation
- Variable frequency ZVS operation
- Average switching frequency: 60 kHz (for each channel at full load)
- Power factor: > 0.99 at full load, 230 Vac
- Total harmonic distortion (THDi): <3% at full load, 230 VAC
- Size = 29.6 x 9.1 x 4.5 cm

Key products

- **MCU control board:** STM32G474QET
- **High-frequency half-bridges:** STW70N60DM6 & STGAP2S
- **Low-frequency half-bridges:** STY145N65M5 & STGAP2S
- **Aux. SMPS:** VIPER25HD

Benefits

- 99.3% peak efficiency at 230 Vac, all bias losses included
- >99.1% flat efficiency from 30% load at 230 Vac
- Heatsink-free and fan-free cooling
- Flexible firmware architecture to implement ZVS, TM (CrM), and CCM mode

Our technology starts with You



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