

XHP™ 3

Power and flexibility for converters



인피니언 전력반도체 솔루션
가상부스에 오신 걸 환영합니다!



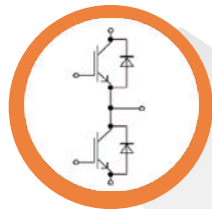
XHP™ stands for...

A 3D rendering of a white robot hand holding a light gray rectangular sign. The hand is positioned at the top and bottom of the sign, with fingers visible at the top. The sign contains the text "Flexible High-Power Platform" in black, with the letters "X", "H", and "P" in pink.

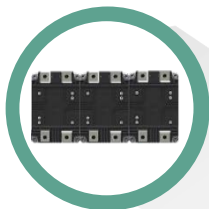
FleXible High-Power Platform

Module concept and features

Half-bridge
configuration



Modular
concept



Low stray
inductance



Internal
symmetry

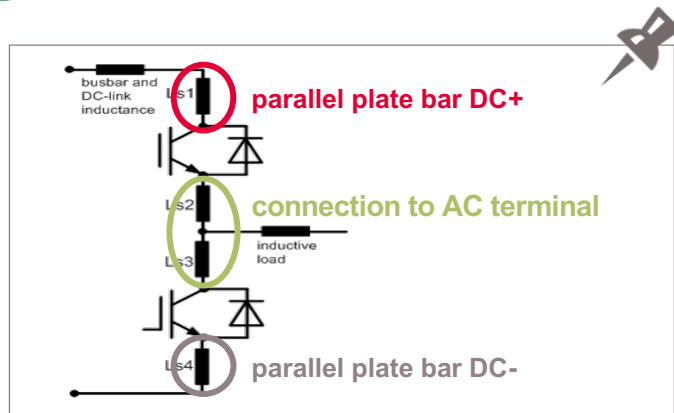


XHP™ 3

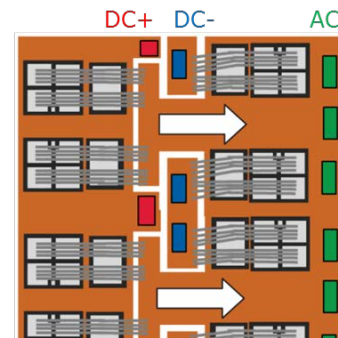
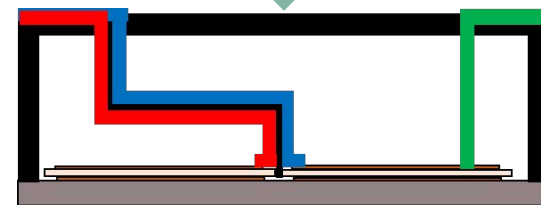
Low-inductive and symmetrical design

Stray inductance impacts...

- ✓ Overvoltage peaks
- ✓ Snappy switching behavior
- ✓ Increased power losses



Parallel plate bar concept



Reduction of
stray inductance value!



Addressing the requirements of 3-level configurations

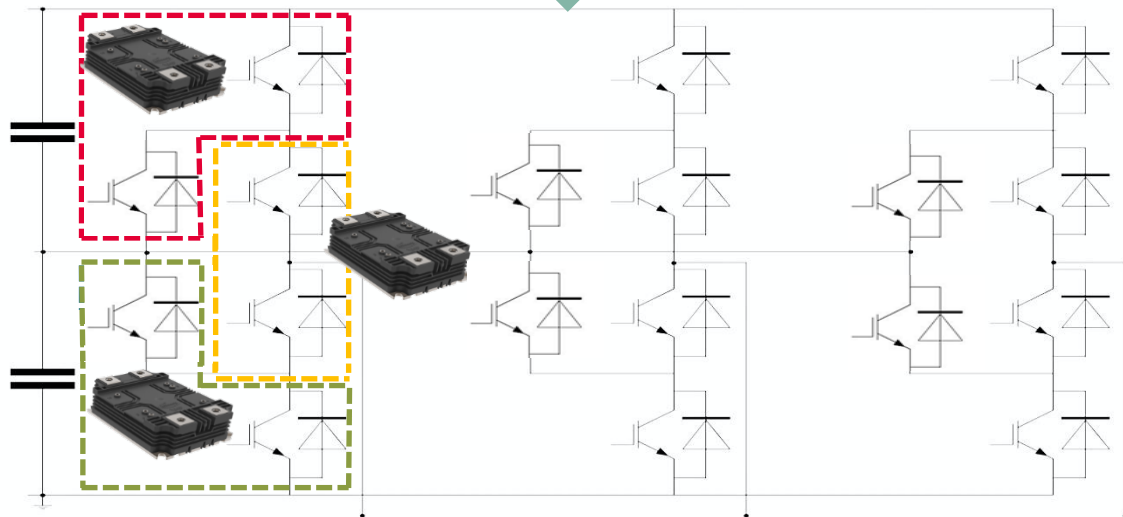
Features

Isolation voltage:
10.4 kV @ $f=50$ Hz, $t=10$ s

Partial discharge voltage:
5.1 kV @ Qpd 10pC typ

CTI 600

Topology



XHP™ 3 3.3 kV with enhanced isolation is the optimal solution
for traction applications with 3-level topologies



3-level topology enables cost and energy savings

Approach:

Reducing transformer copper power dissipation

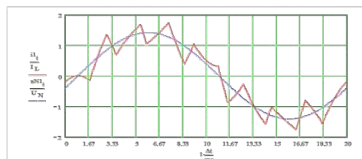
$P_{\text{loss,Cu}}$

- › $P_{\text{loss,Cu}} \sim \text{Cu wire length } l_{\text{Cu}}$
- › Reducing #N of winding turns
 - add. effect: Lower copper material costs
- › Demand of same magnetic flux B
 - Bigger core area A
- › Lower stray inductance $L_{\text{s,Tr}}$
 - **Higher ripple current ΔI** ⚡

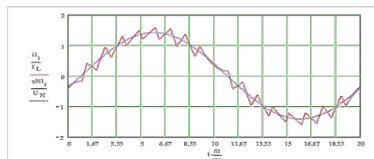


Reduction of ripple current ΔI due to 3-level topology

2-level



3-level

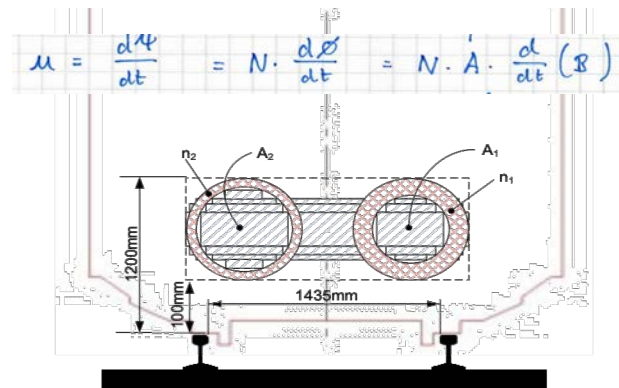


Up to 40% less copper needed for transformer (cost savings)



More than 40% transformer efficiency gain

EMU power transformer



Summary

Key application requirements

- ✓ Highly scalable inverter designs
- ✓ Higher power density
- ✓ Clean switching

Product offering

- › XHP™ 3
 - FF450R33T3E3
 - FF450R33T3E3_B5
- › More types to follow in 2019/2020



Key benefits

- ✓ Modular concept for excellent scalability & longer lifetime
- ✓ Design-in process accelerated due to simplified mechanical design
- ✓ Low inductive and symmetrical design in half-bridge configuration for clean switching
- ✓ Ready for 3-level applications with increased demand for isolation (10 kV)

XHP™ 2

Power and flexibility for converters

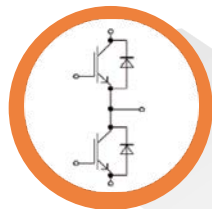


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XHP™ 2 concept and features

Half-bridge
configuration



Low stray
inductance



Symmetrical
design

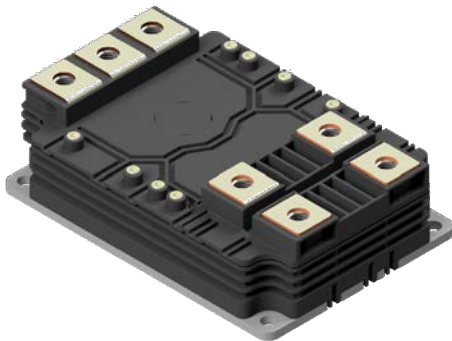


High PC
robustness




XHP™ 2

Next step: New package XHP™ 2



- › **XHP™ 2 (T2)** package for
1200 V / 1700 V / 3300 V
- › **XHP™ 3 (T3)** package for
3300 V / 4500 V / 6500 V

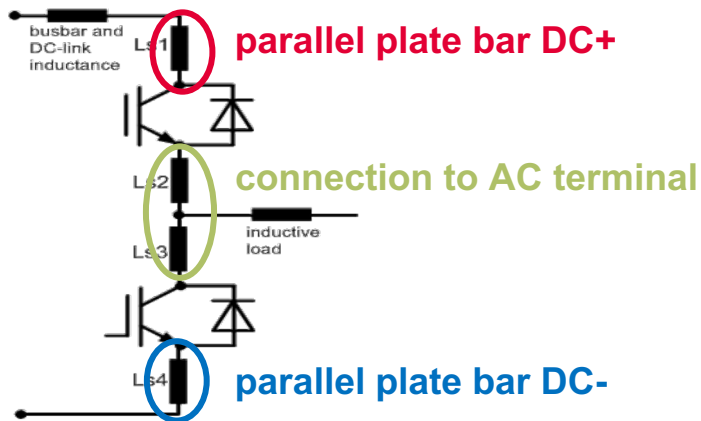
Features	Benefits
XHP™ 2: Low stray inductance and symmetrical design	Ready for fast switching devices (e.g. enabling lowest losses) 
"Flow through" concept with PCB on top	Simplified manufacturing
Modular concept and same module geometry as XHP™ 3	Supporting platforms, same parts concepts and scalability

Modular concept for low inductive design

Technical motivation

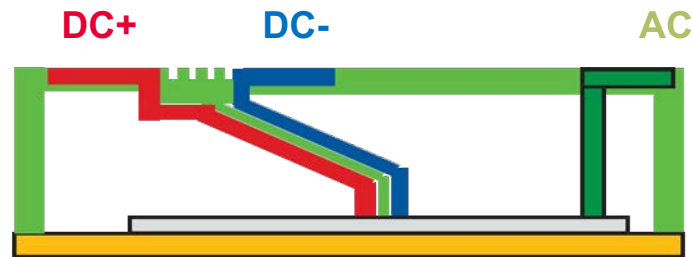
Stray inductance results in

- › overvoltage peaks
- › snappy switching
- › higher dynamic losses



Principal concept

Strip line concept









Half-bridge module



R. Bayerer, D. Domes: Power circuit design for clean switching, CIPS, 2011

XHP™ portfolio 1.7 kV – 6.5 kV

XHP™ 3 Half-bridge	 IGBT3 FF225R65T3E3*	6.5 kV 10.4 kV isolation
XHP™ 3 Half-bridge	 IGBT3 FF450R33T3E3_B5	3.3 kV 10.4 kV isolation
XHP™ 3 Half-bridge	<div>   </div> <div> IGBT3 FF450R33T3E3 IGBT4 .XT FF550XTR33T3E4* </div>	3.3 kV 6 kV isolation
XHP™ 2 Half-bridge	<div>   </div> <div> IGBT5 .XT FF1200XTR17T2P5* IGBT5 .XT FF1800XTR17T2P5* </div>	1.7 kV 4 kV isolation
<div> <div>225 A</div> <div>450 A</div> <div>550 A</div> <div>1200 A</div> <div>1800 A</div> </div> <div>Nom. current</div>		

* Under development



Part of your life. Part of tomorrow.