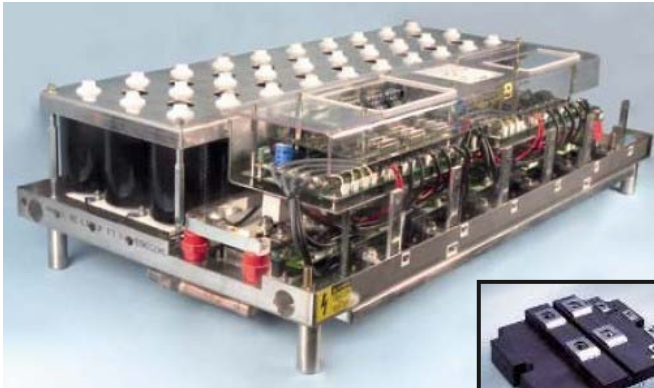


IGBT Stacks

- ModSTACK™
- ModSTACK™-HD
- PrimeSTACK™

Present

ModSTACK

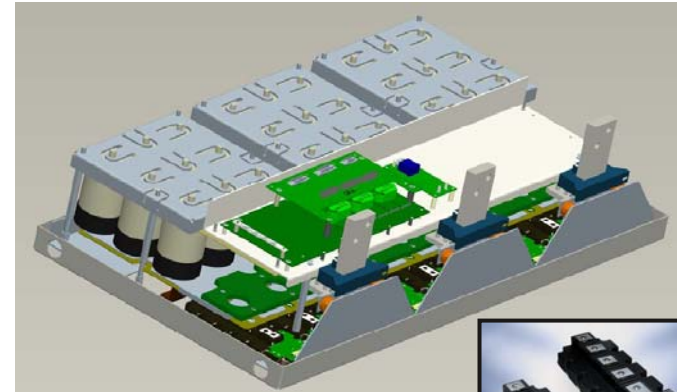


PrimeSTACK

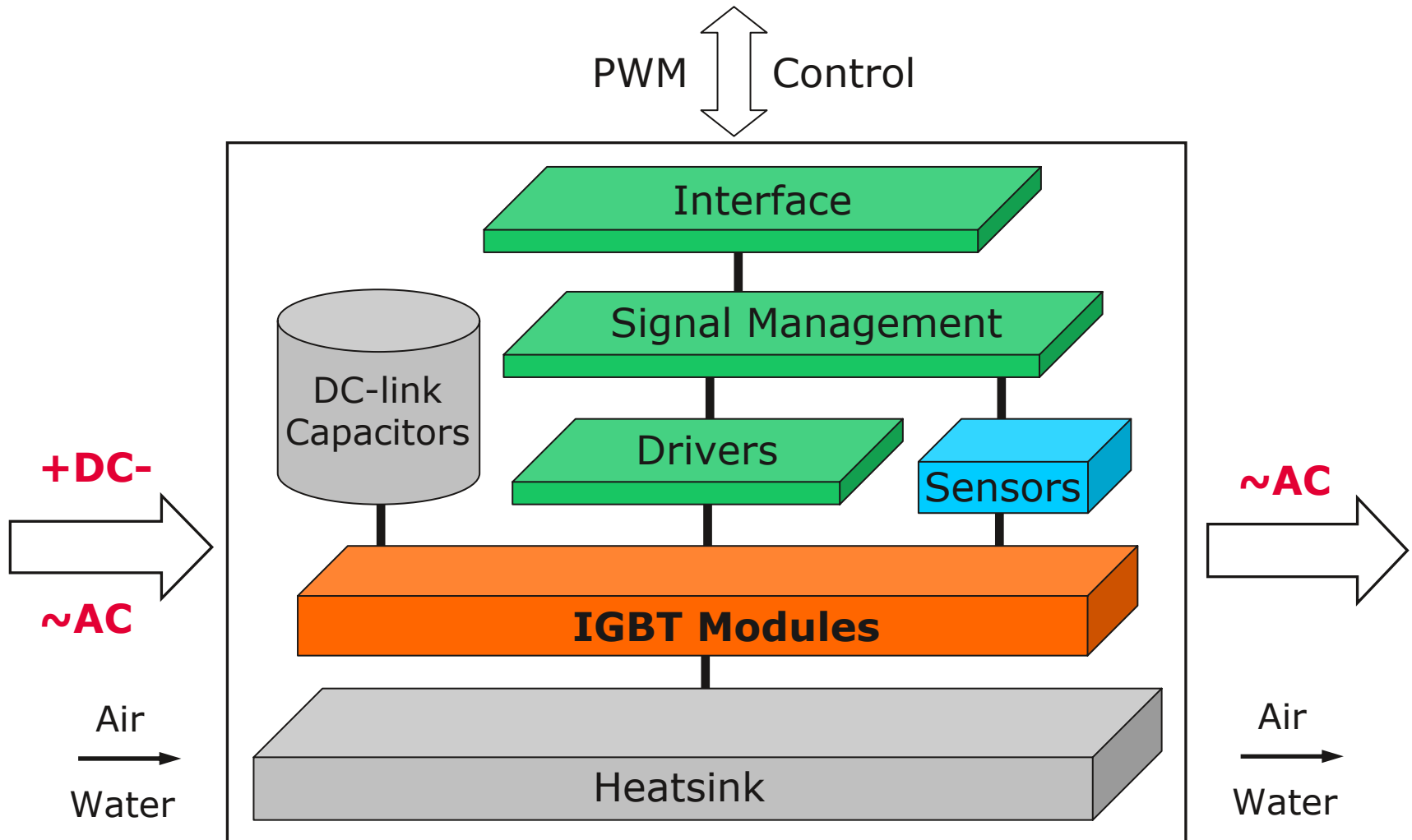


New

ModSTACK-HD



IGBT Stack – Concept

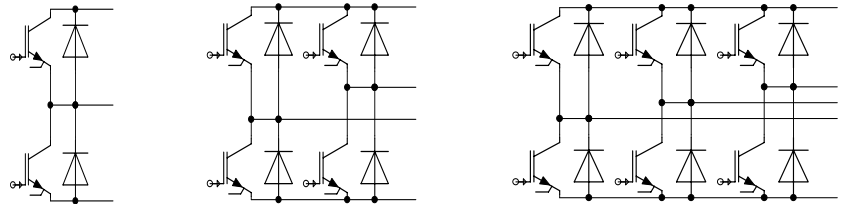


■ IGBT Modules

- All dual-switch modules ("FF")
- 62mm, IHM, PrimePACK
- 600V, 1200V, 1700V

■ Main Circuit Topology

- Half-bridge (1/2B2I)
- H-bridge (B2I)
- 3-phase bridge (B6I)
- Back-to-back converter (B6I+B6I)



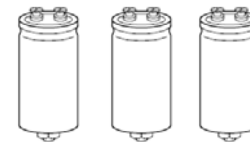
■ Functionality

- Gate driving
- Sensing
- Protection



■ DC-link capacitors

- Electrolytic capacitors
- Foil capacitors



■ Heatsink

- Water cooled
- Forced-air cooled

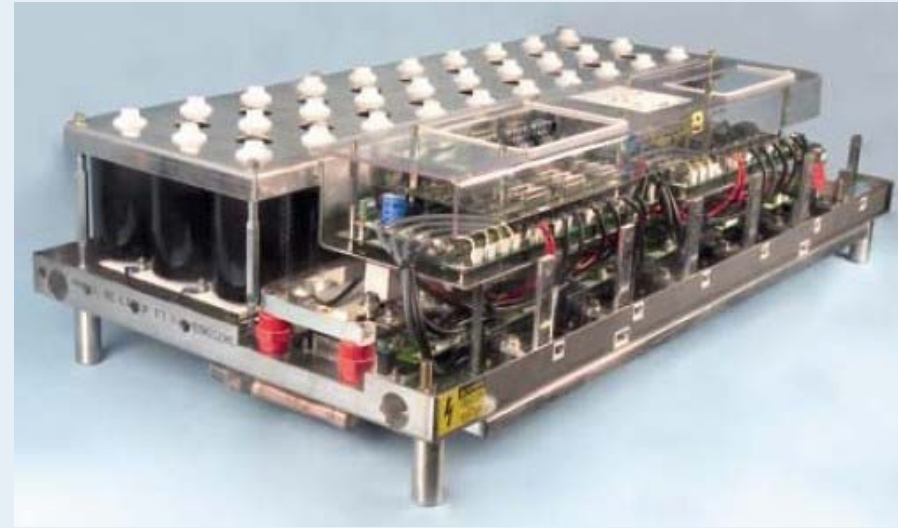


■ Interface

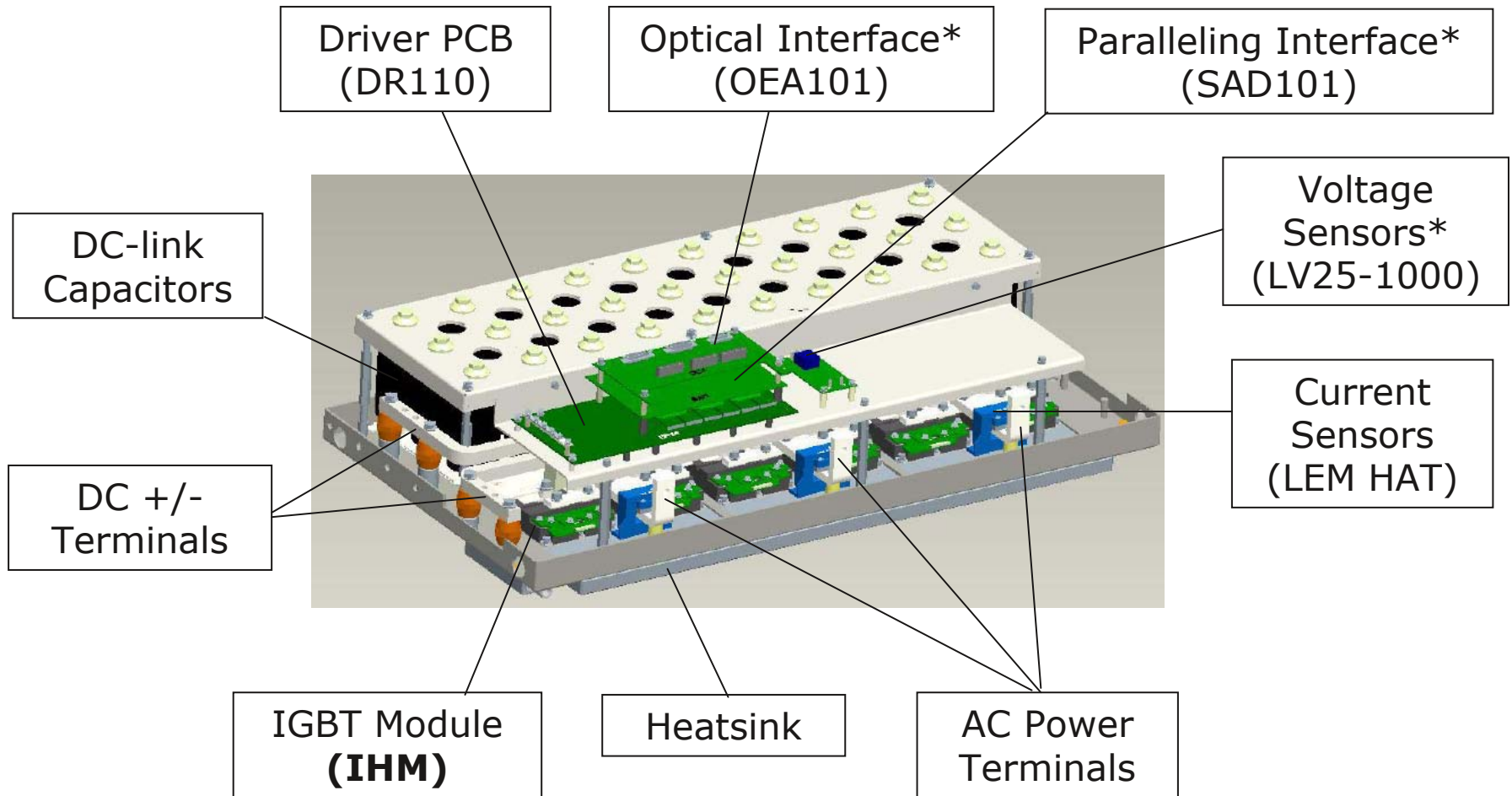
- Electrical
- Optical
- Paralleling



ModSTACK™



ModSTACK™ - Main Components

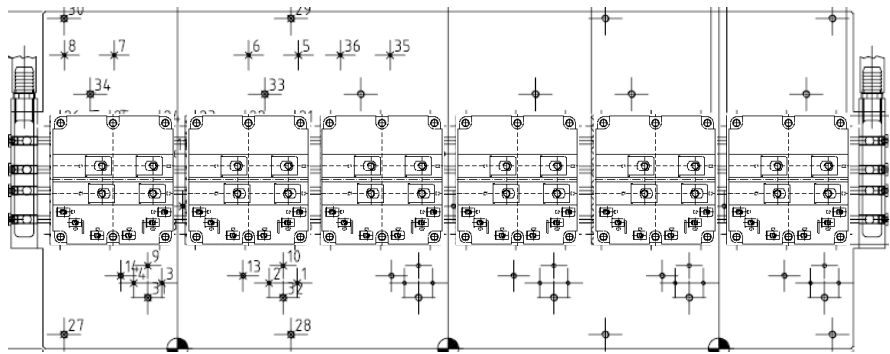


ModSTACK™ - Main Topology

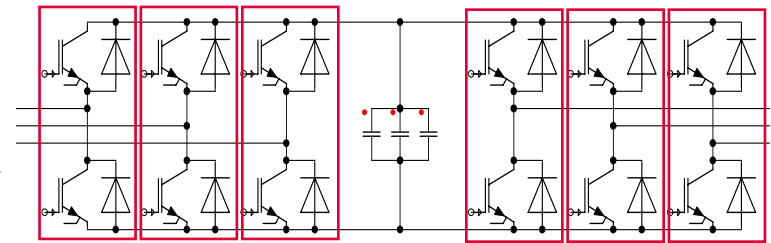
- ModSTACKs use **IHM 140x130 Dual-switch** modules. →
FF-; **1200V, 1700V**; 600A-800A-1200A



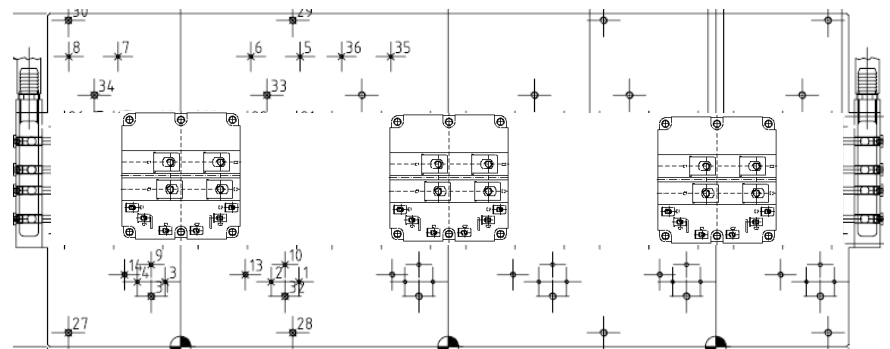
- ModSTACK™3 can use maximally 6 IHMs, which can form a back-to-back converter topology or 3-phase converter topology by paralleling of 2 IHMs.



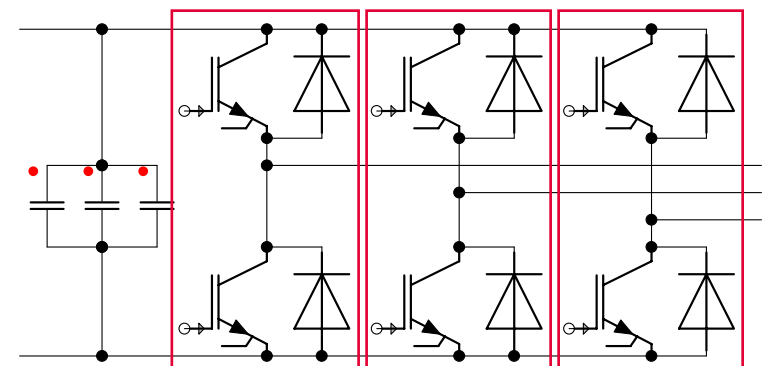
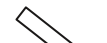
e.g. ModSTACK3



Back-to-back Converter



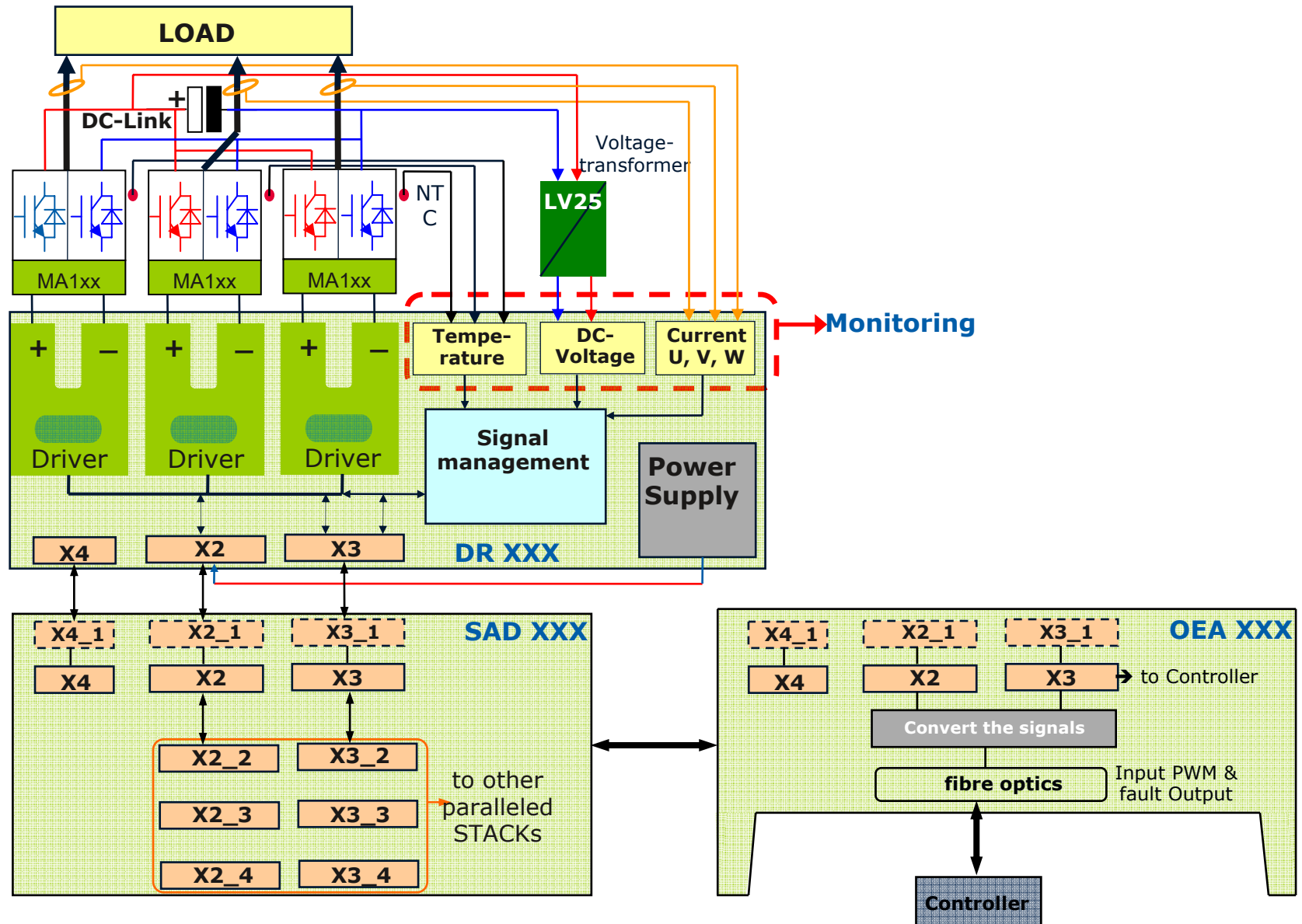
e.g. ModSTACK3



3-phase Converter

By paralleling
of two IHMs

ModSTACK™ - Functional Boards



Gate Driving

- EiceDRIVER™ 2ED300C17-S, one for each half-bridge
- Adaptor board on each module

Sensing

- AC current on each phase
- Temperature on heatsink
- DC-link voltage (optional)

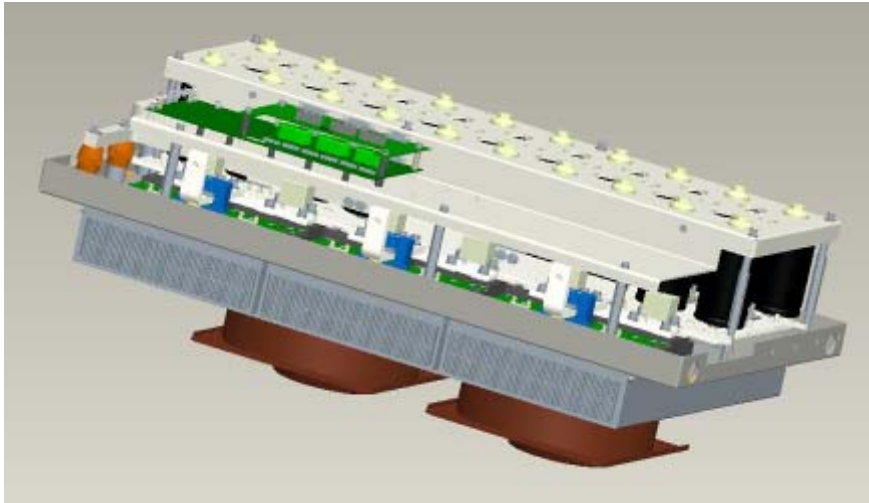
Protection

- Short Circuit: via Vcesat monitoring with EiceDRIVER™
- Over Current: via current sensor
- Over Voltage: via voltage sensor (optional)
- Over Temperature: via NTC & chip temperature simulation

Signal Input & Output

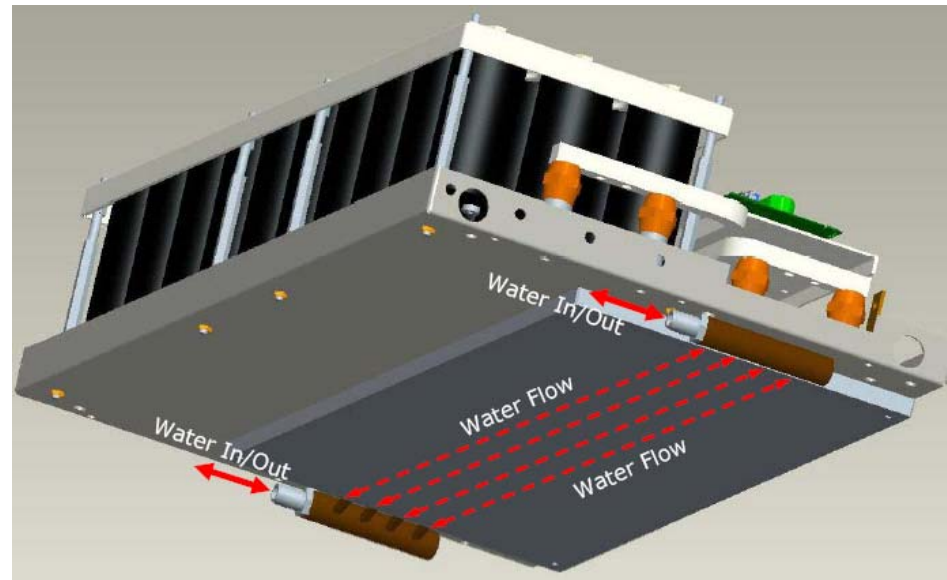
- PWM Inputs (Digital) – electrical or optical
- Fault Outputs (Digital) – electrical or optical
- Analog Current/Temperature/Voltage Outputs (Analog)

ModSTACK™ – Cooling

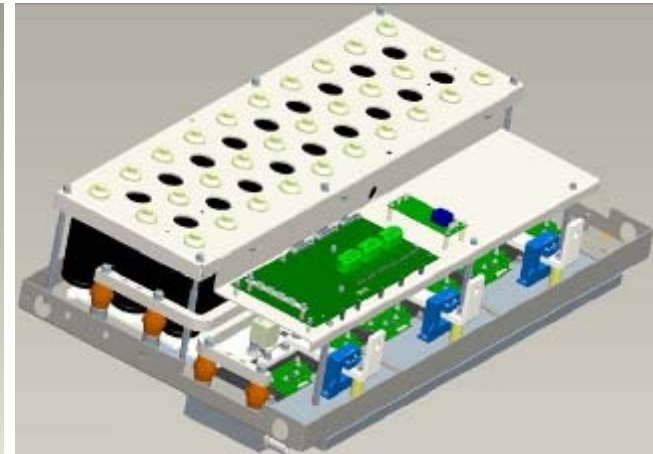
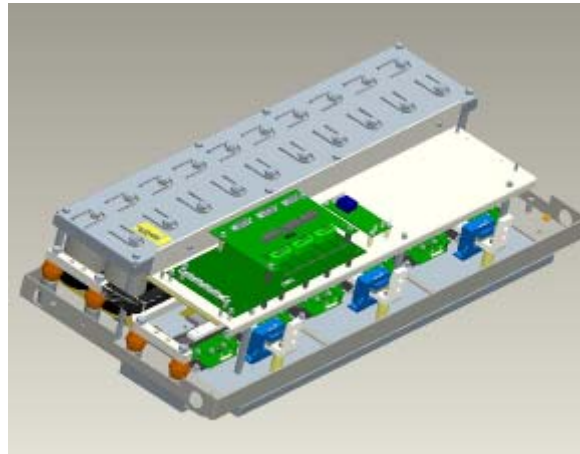


← Forced Air Cooling

Water Cooling →
(Al-tube or Cu-tube)



ModSTACK™3 – Size & Capacitor Layout



Size

- L = 1090mm
- D = **396mm**

Capacitors

- Foil
- Max. 10 paralleled
- 1 Row

Size

- L = 1090mm
- D = **496mm**

Capacitors

- Foil or Electrolytic
- Max. 20 paralleled
- 2 Rows

Size

- L = 1090mm
- D = **596mm**

Capacitors

- Foil or Electrolytic
- Max. 30 paralleled
- 3 Rows

Module

- IHM standard modules (FFxxxxRxxKE3)
- IHM traction modules (FFxxxxRxxKE3_B2)

Capacitor (for ModSTACK3)

- Electrolytic Capacitors
2 rows (max. 20 pcs) or 3 rows (max. 10 pcs)
- Foil capacitors
1 row (max. 10 pcs), 2 rows (max. 20 pcs) or 3 rows (max. 10 pcs)

Depth

- 396mm (for foil capacitors in 1 row)
- 496mm (for foil/electrolytic capacitors in 2 rows)
- 596mm (for foil/electrolytic capacitors in 3 rows or 2 rows)

Heatsink

- Air cooled (with fans or without fans)
- Water cooled (Al-tube or Cu-tube, front-side or back-side water connection)

DC +/- Terminals

- On the same side (right or left)
- One right & one left

ModSTACK™ – Type Designation



6 MS 2400R17KE3 - 3 W C H – IO V

B6I

ModSTACK

2×FF1200R17KE3(B2) per phase

MS3

Water Cooling

Copper Tube

High Efficiency Heatsink

Optical Interface

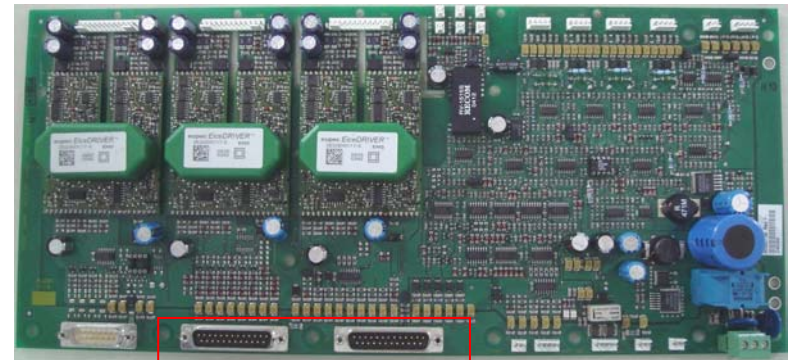
Voltage Sensor

ModSTACK™ – Paralleling

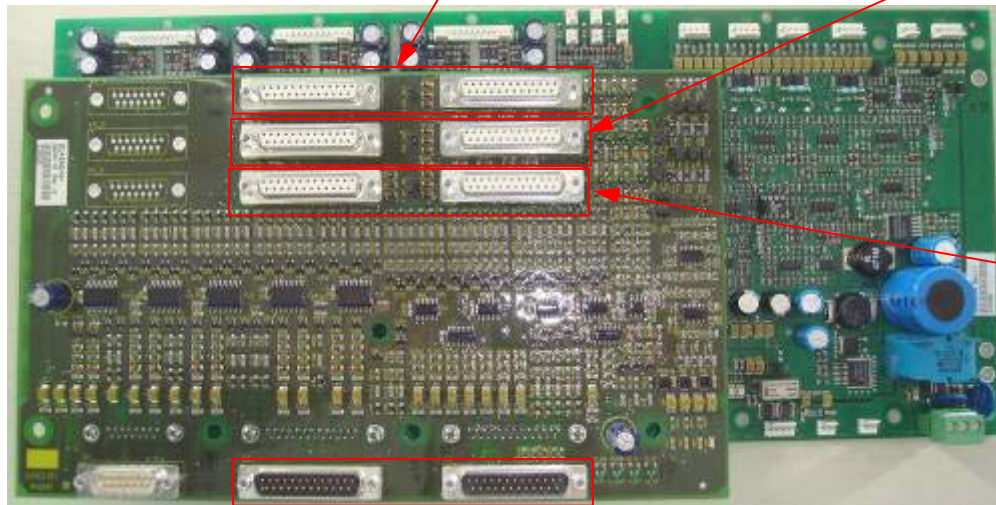
Stack#2 (Slave)



Stack#3 (Slave)

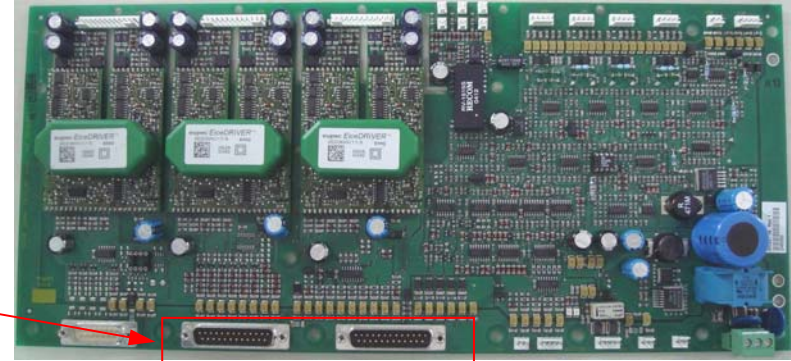


Stack#1 (Master)



To/From Controller

Stack#4 (Slave)



With the paralleling interface, it is possible to parallel maximally four ModSTACKs.



Example 1:

- 1.5MW Wind-power Direct Drive Converter
- DC-link 1100V
- 2x B6I units paralleled for grid side; 2 for rotor side.

Example 2:

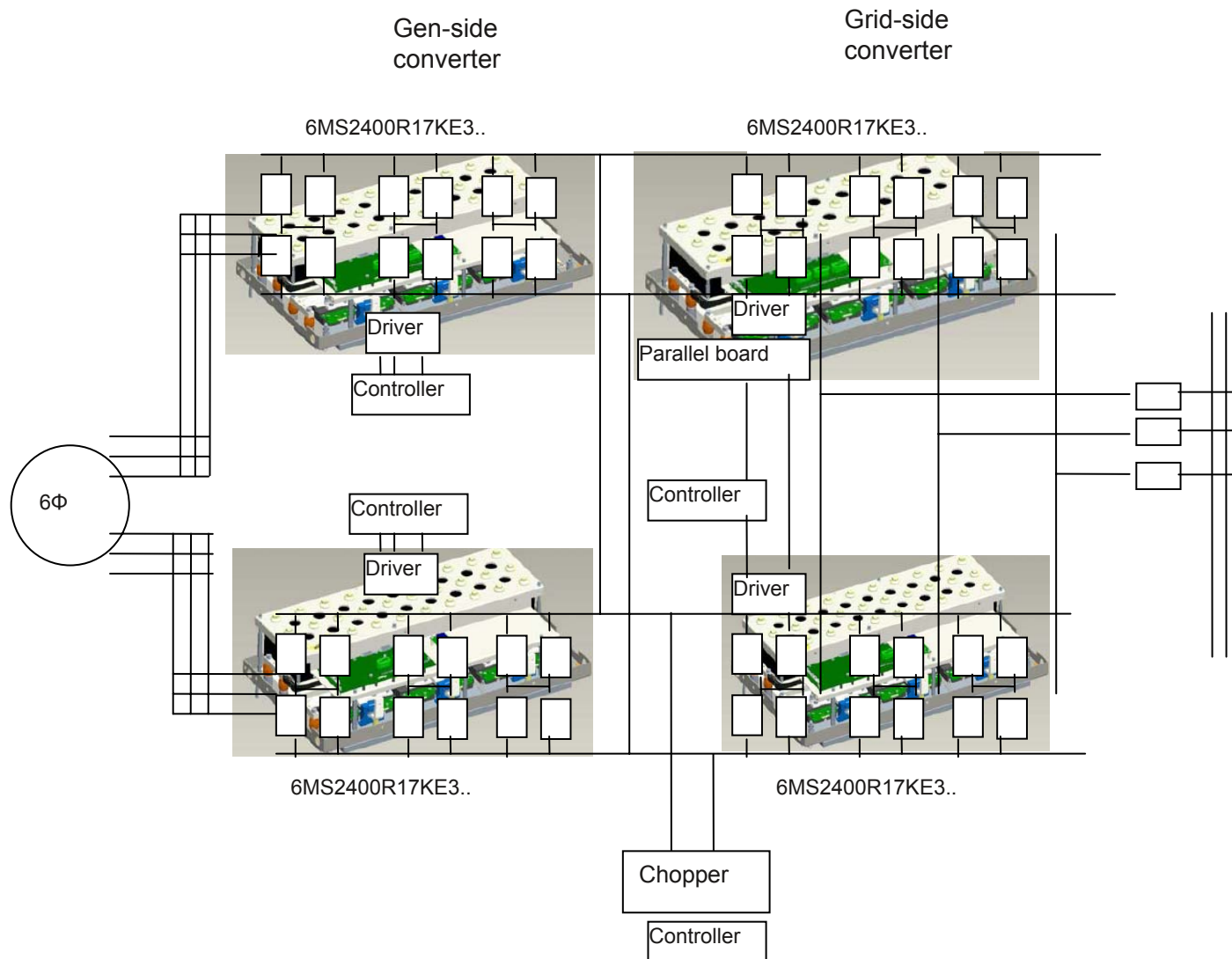
- 2MW Wind-power Double-feed Converter
- DC-link 1100V
- 1x B6I unit for grid side & rotor side each

Example 3:

- 1500A Drive @ 690Vac
- DC Link 1000...1100V
- 4 parallel B6I Units
- Water Cooling
- Cabinet Base 800x600
- Application: Heavy Drive Units for Oil and Gas Down Drilling



ModSTACK方案举例：2.5MW直驱式风电变流器



ModSTACK™ HD

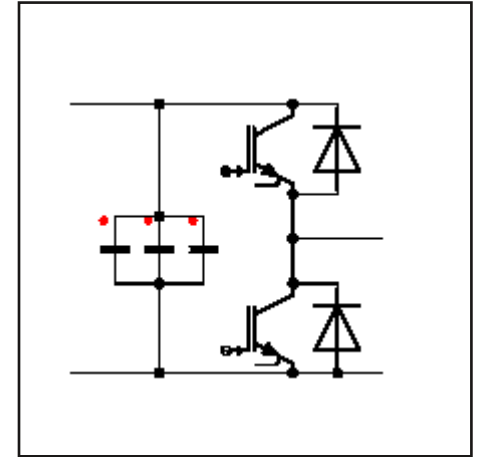
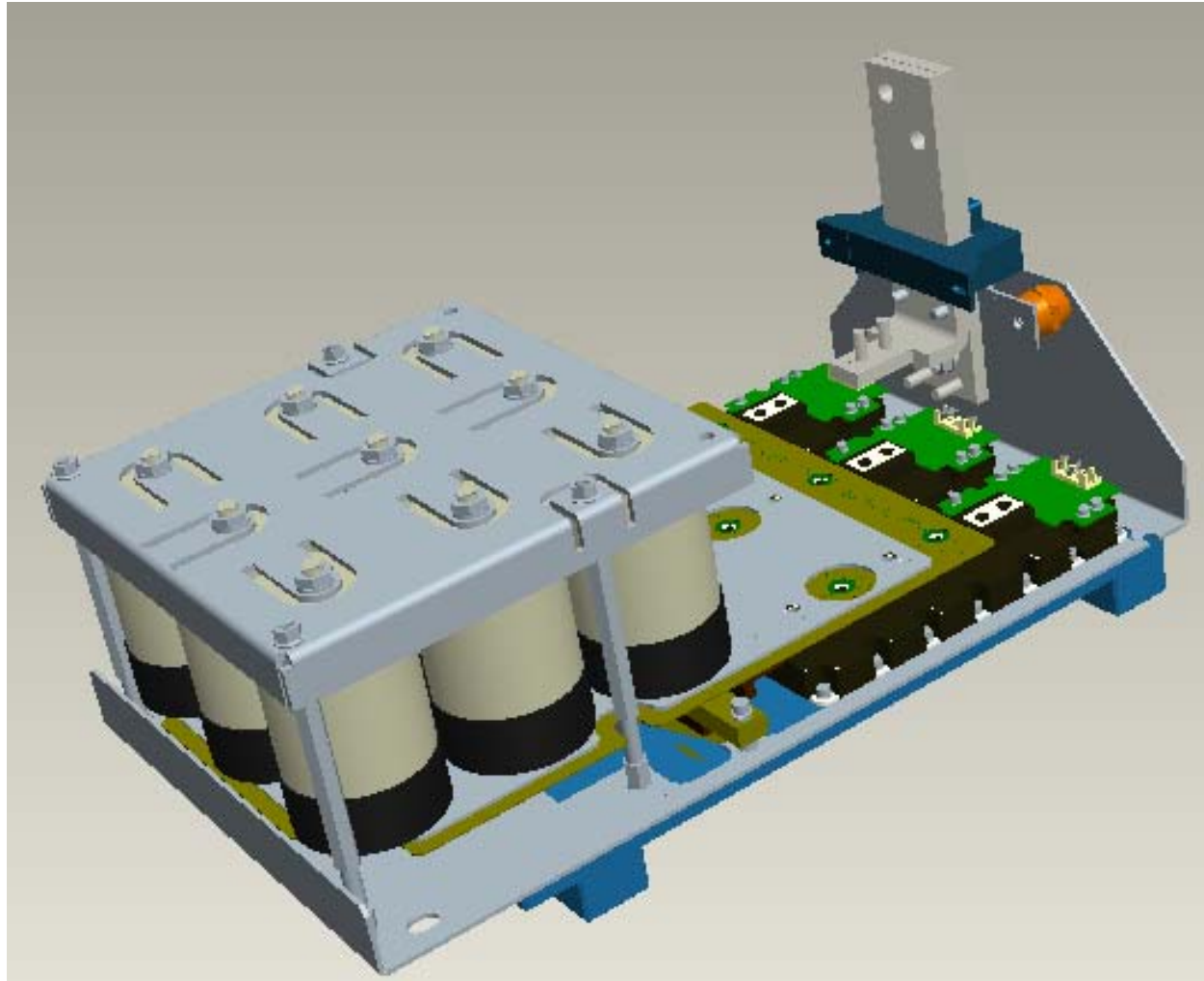
ModSTACK™ High Density with PrimePACK™

The evolution for the well known ModSTACK™ packages

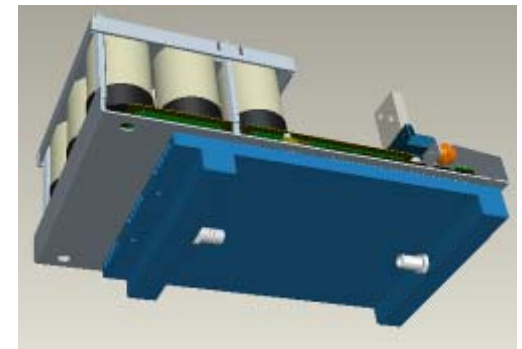
All data are target data



ModSTACK™ HD halfbridge stack based on PrimePACK™3

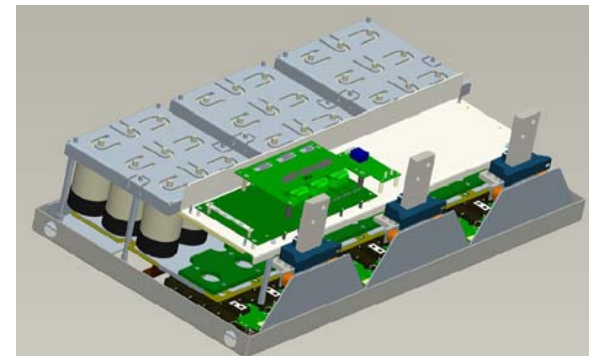
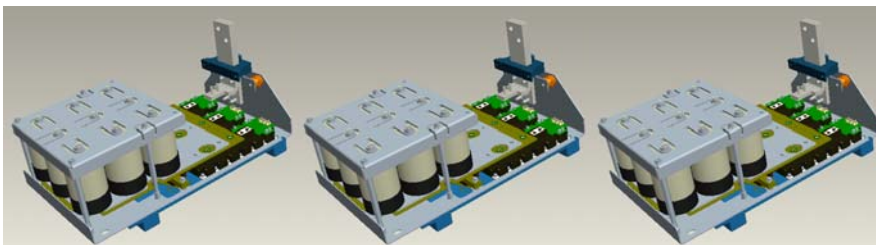


Package MS2W B10



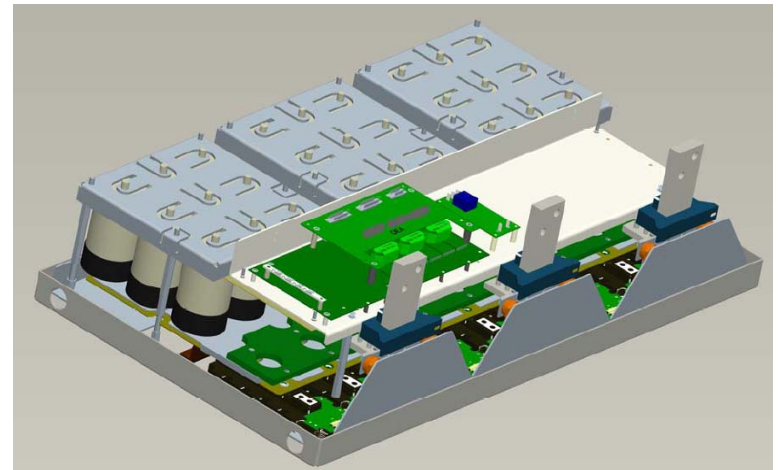
ModSTACK™ HD - Phase Module

- Up to
 - 3 PrimePACK 2 or 3
 - 9 MP capacitors, alternative electrolytic capacitors (needs an additional capacitor box)
 - 690V rms
 - 1100V DC nominal
 - 1700A rms (target)
- Driver DR240 for one phase unit, alternative DR110 for three phase unit (EiceDRIVER™ included)
- Water-cooled heatsink with copper or aluminium tubes
- Designed for a mounting frame for up to 3 phase modules.
 - Dimensions comparable to to ModSTACK 3 package



ModSTACK™ HD with PrimePACK™

- Special features
 - Based on the dimensions of the ModSTACK family
 - Please read also the ModSTACK Product Presentation
 - High temperature of module allowed
 - Flexible adaption of power terminals
 - Limited heat flow from module to capacitors
 - Dynamic Active Clamping (optionally)
 - Back to back mounting possible
 - Less copperbars for back to back converter



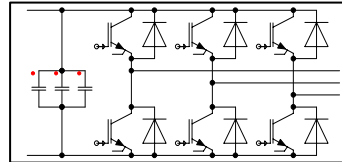
ModSTACK™ HD Evolution

Based on PrimePACK™ 3, increased power range for several applications



- Current package: MS3W
(also available)
- 6* IH2 (FF1200R17KE3)

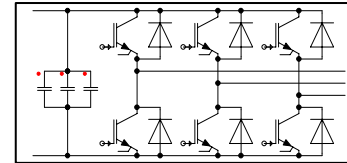
- 3*1100 Arms
- 3* 690 Vrms



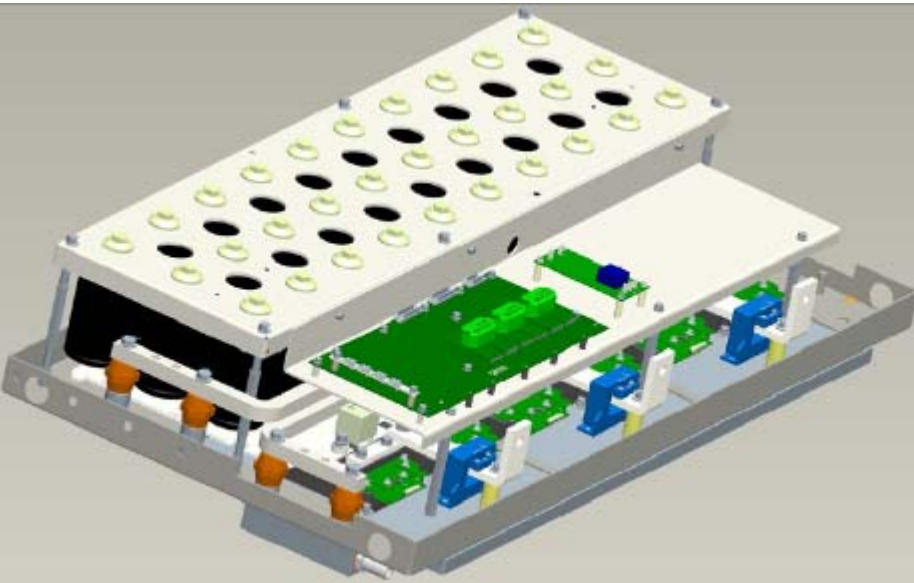
- 1.3 MVA Inverter

- Improved package: MS3W B10
(B10 -> HD concept)
- 9* PP3 (FF1000R17IE4)

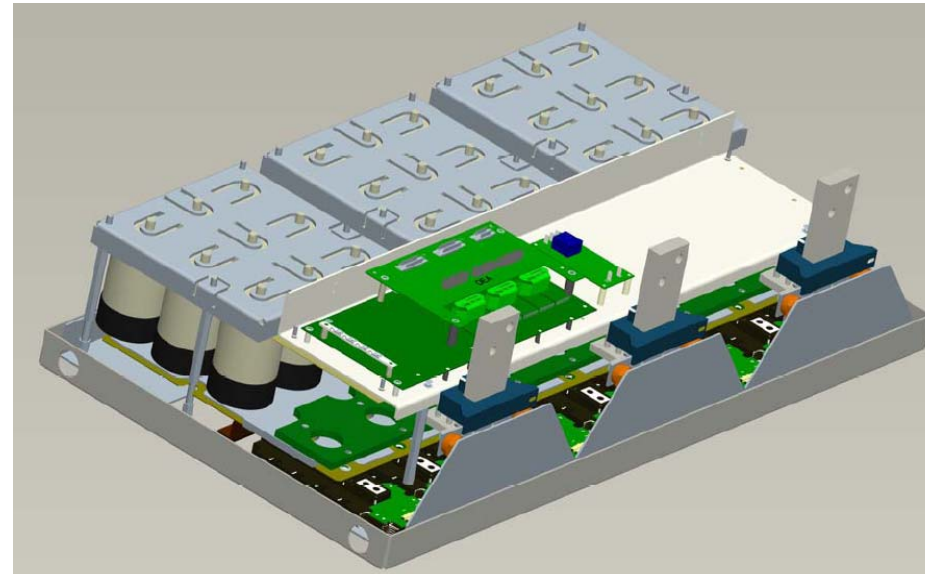
- 3*1700 Arms
- 3* 690 Vrms



- 2 MVA Inverter (+54%)

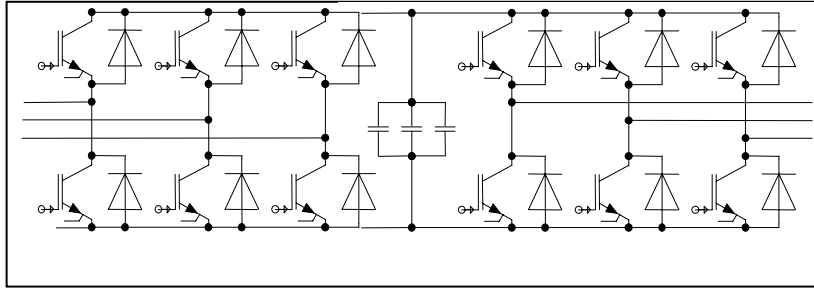


6MS2400R17KE3-3WAH-CxVT

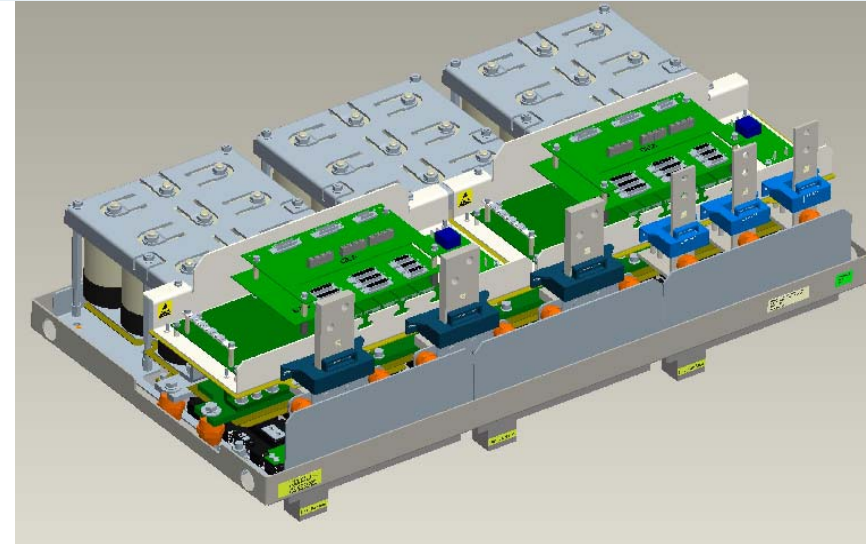


6MS3000R17IE4-3WAH-CxB10VT

ModSTACK HD in B6I+B6I configuration (asymmetric)



B6I+B6I



12MS2000R17KE3-3WAH-MCxB10IOVT

Incl. Option:
Optical Interface and
Paralleling Interface
Voltage Sensor

- Package: MS3W B10

- 9* PP3 (FF1000R17IE4)

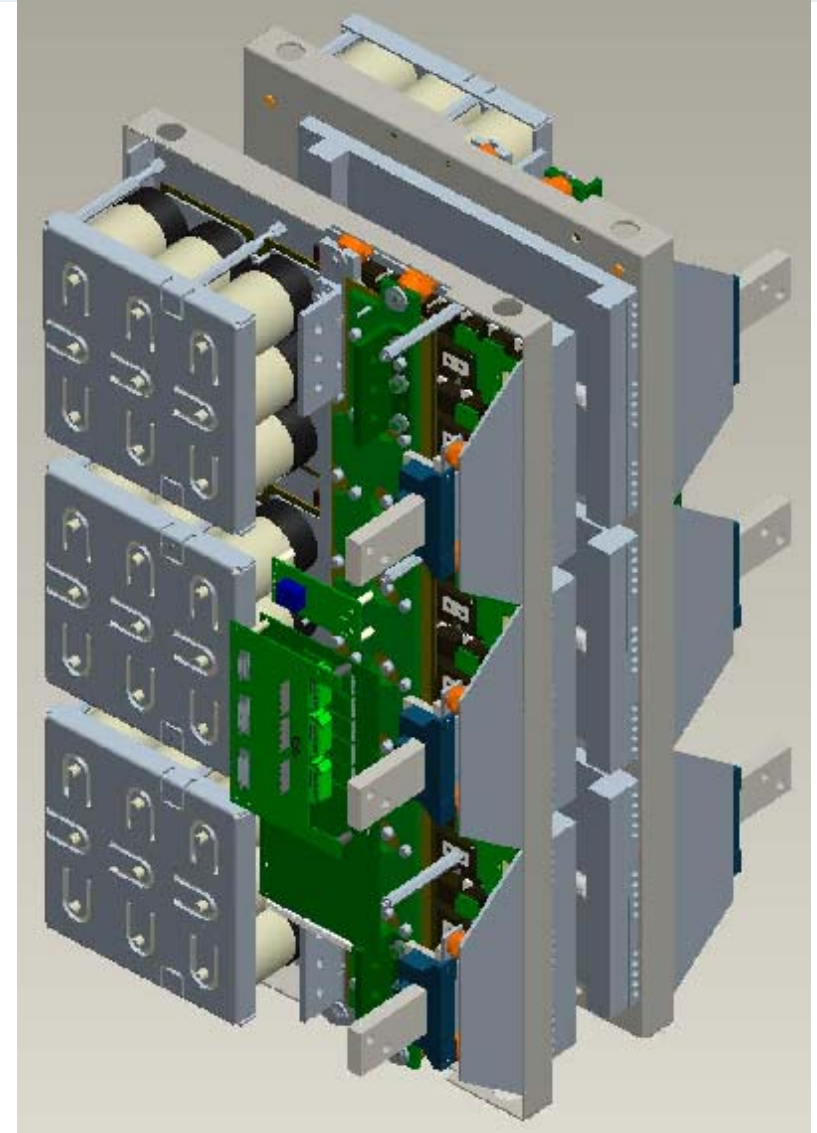
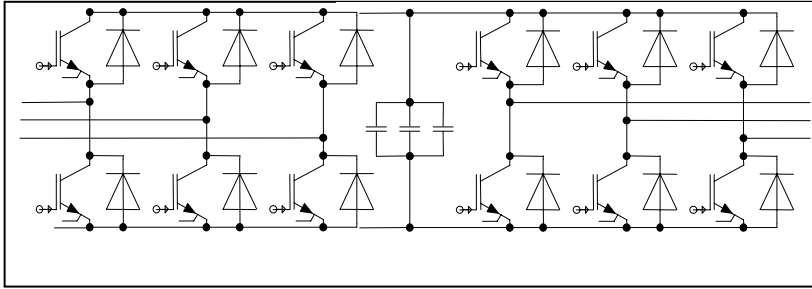
- 3*1150 Arms

- 3* 560 Arms

- 3* 690 Vrms

- For Wind Power Systems based on DFIG

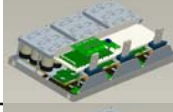
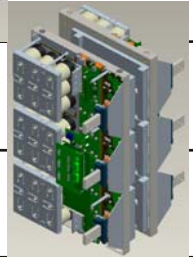
ModSTACK™ HD B6CI+B6CI stack based on PrimePACK™, vertically mounted



12MS3000R17KE3-6WAH-MCxB10IOVT

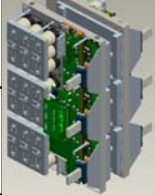
- Package: MS6W B10
- 18* PP3 (FF1000R17IE4)
- 2*3*1700 Arms
- 3* 690 Vrms
- 2 MVA Full Inverter
e.g. for Wind Power Systems based
on Synchronous Generator

Planned package range (water cooled)

Package	Circuit	Suitable PrimePACK™	Weight	Dimensions w*d*h [mm]	
MS2WB10	B6I	3* PP2 or PP3	32 kg	400*596*370	
MS3WB10	B6I+B6I	9* PP2 or PP3	100 kg	1090*596*370	
MS2WB10	1/2B2I	3* PP2 or PP3	32 kg	400*596*370	
MS3WB10	B2I	9* PP2 or PP3	100 kg	1090*596*370	
MS3WB10	B6I	9* PP2 or PP3	125 kg	1090*596*370	
MS6WB10	B6I+B6I	18* PP2 or PP3	270 kg	1090*596*850	

All data are target data

Planned type range (water cooled)

Current *) [Arms]	Type	Circuit	Package		Included PrimePACK™
3* 560	6MS1000R17IE4-2WAHCxB10	B6I		MS2WB10	3*FF1000R17IE4
2*3* 560	12MS1000R17IE4-3WAHCxB10	B6I+B6I		MS3WB10	6*FF1000R17IE4
3* 1150A 3* 560A	12MS2000R17IE4-3WAHCxB10	B6I+B6I		MS3WB10	9*FF1000R17IE4
1* 1700	2MS3000R17IE4-2WAHCxB10	1/2B2I		MS2WB10	3*FF1000R17IE4
2* 1700	4MS3000R17IE4-3WAHCxB10	B2I		MS3WB10	6*FF1000R17IE4
3* 1150	6MS2000R17IE4-3WAHCxB10	B6I		MS3WB10	6*FF1000R17IE4
3* 1700	6MS3000R17IE4-3WAHCxB10	B6I		MS3WB10	9*FF1000R17IE4
2*3* 1150	12MS2000R17IE4-6WAHCxB10	B6I+B6I		MS6WB10	12*FF1000R17IE4
2*3* 1700	12MS3000R17IE4-6WAHCxB10	B6I+B6I		MS6WB10	18*FF1000R17IE4

Basic stacks, others on request

All data are target data

*) typical output current (preliminary) at VDC=1100V, fsw=2 kHz, VAC=690V, f_0=50Hz, cos_phi=0,85, Ta=40° C, Tjmax=Tjop

Example: **6MS3000R17IE4-3XXX**

- 6** **→** Circuit Topology of the power section (amount of switches, here: six switches 3x plus, 3x minus => 2, 4, **6**, 12)
- MS** **→** Stack family ModSTACK
- 3000** **→** Installed nominal current of the IGBT's
- R** **→** "Reverse conducting", i.e. each circuit has an antiparallel diode
- 17** **→** Maximum blocking voltage (here 1700V)
- IE4** **→** Generation of the IGBT -Chip
- 3** **→** Package => 1=MS1, 2= MS2, **3**=MS3, 4=MS4
- XXX** **→** Description several extension options (amount of IGBT modules, Cooling method, mechanical dimension, Option Key, etc.)

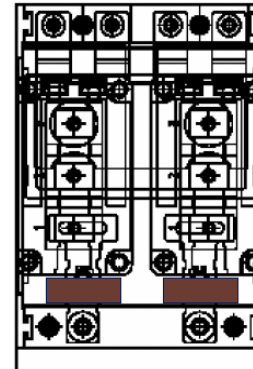
PrimeSTACK™



英飞凌

PrimeSTACK™ – Frame Sizes

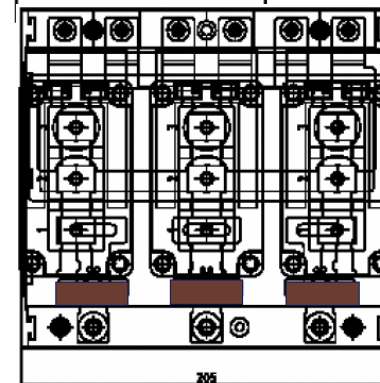
PrimeSTACK™2



2× 62mm modules



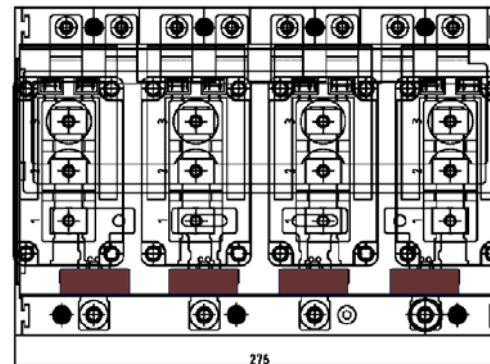
PrimeSTACK™3



3× 62mm modules

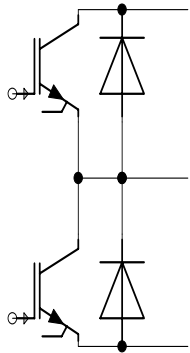


PrimeSTACK™4

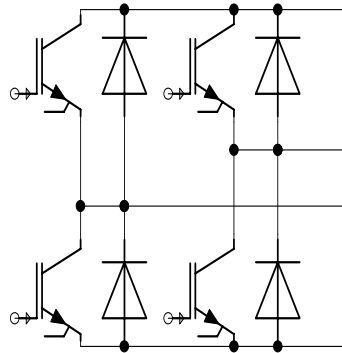


4× 62mm
modules

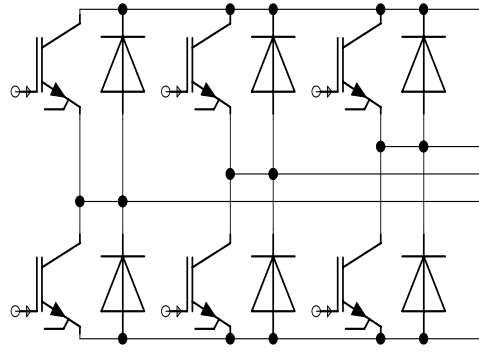




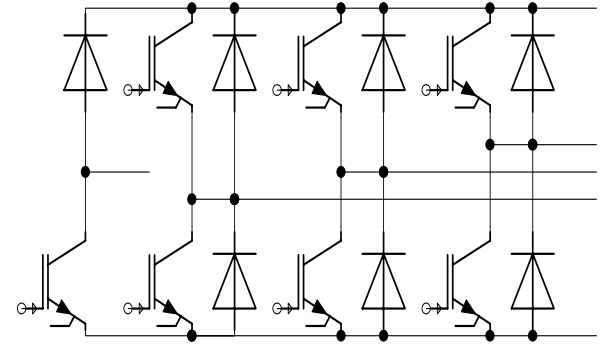
2pack



4pack

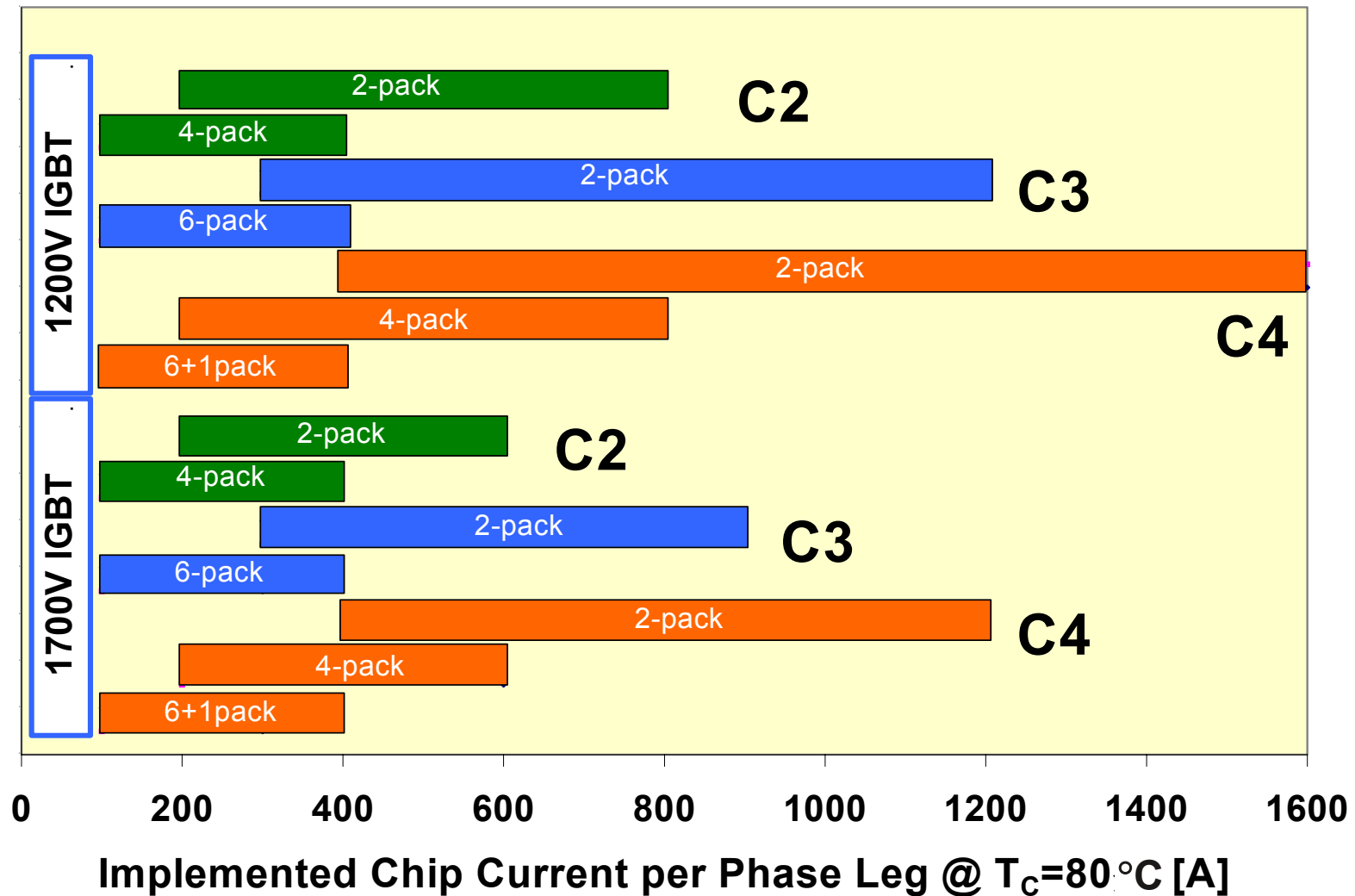


6pack

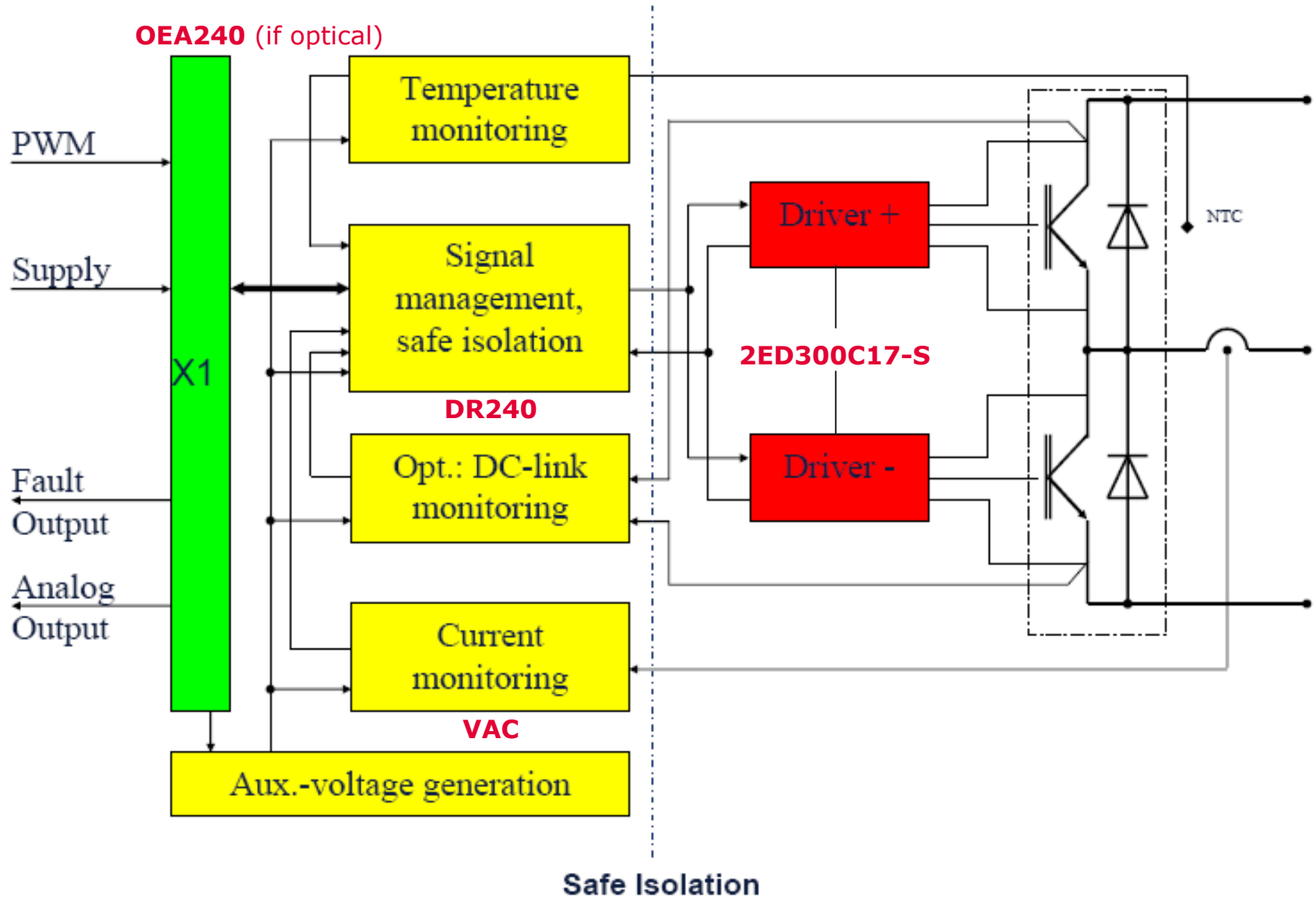


6pack + chopper

PrimeSTACK™ - Product Range



PrimeSTACK™ - Functional Diagram



Gate Driving

- EiceDRIVER™ 2ED300C17-S, one for each half-bridge
- Adaptor board on each module

Sensing

- AC current on each module
- Temperature on heatsink and PCB (ambient)
- DC-link voltage (optional)

Protection

- Short Circuit: via Vcesat monitoring with EiceDRIVER™
- Over Current: via current sensor
- Over Voltage: via voltage sensor (optional)
- Over Temperature: via NTC & chip temperature simulation (optional)

Signal Input & Output

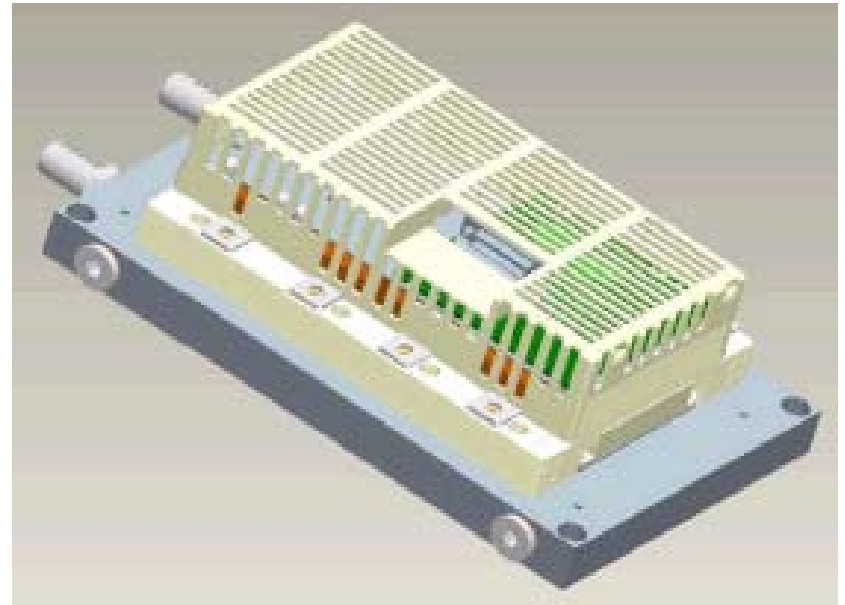
- PWM Inputs (Digital) – electrical or optical
- Fault Outputs (Digital) – electrical or optical
- Analog Current/Temperature/Voltage Outputs (Analog)

PrimeSTACK™ – Cooling Method

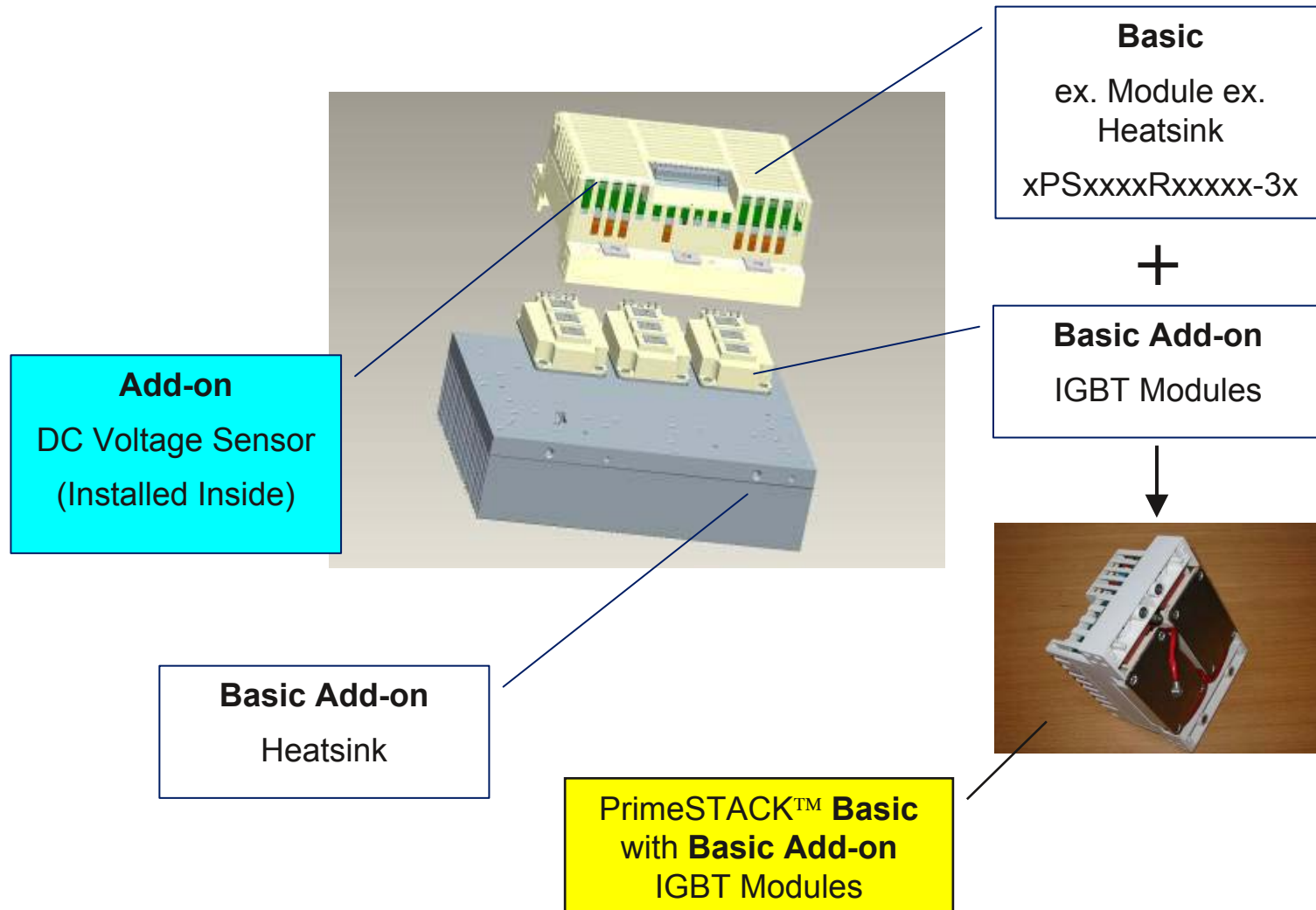


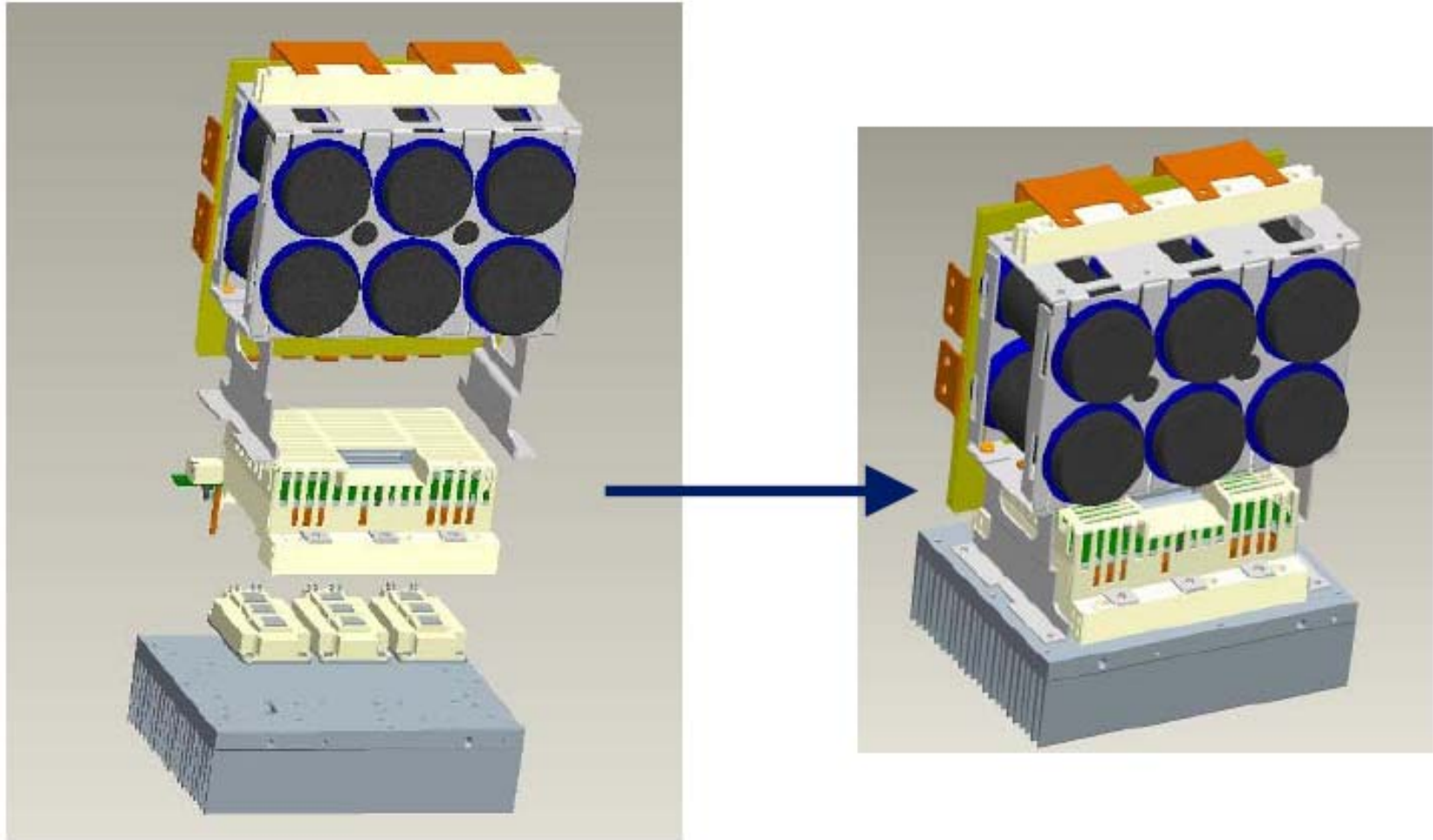
← Forced Air Cooling

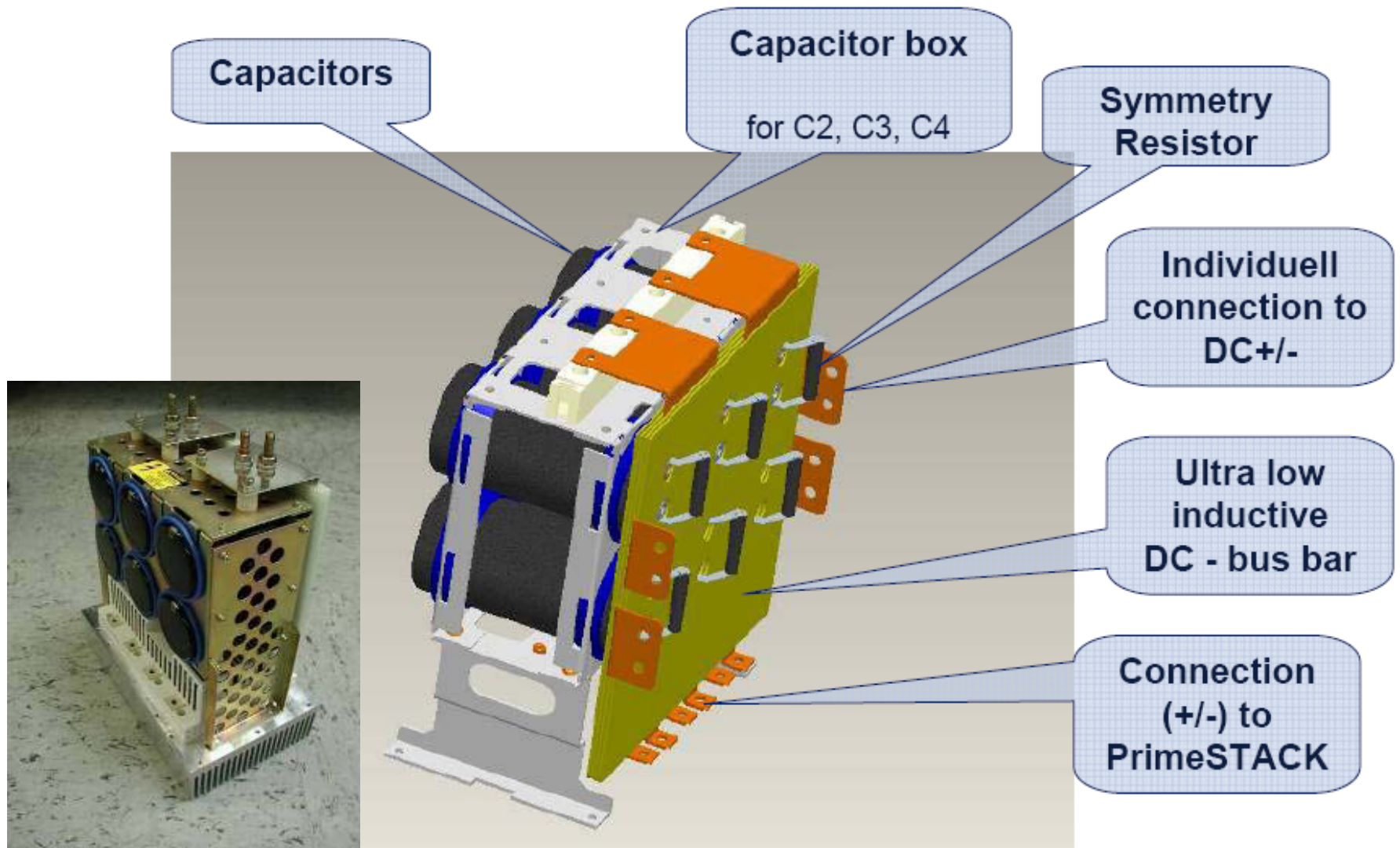
Water Cooling →

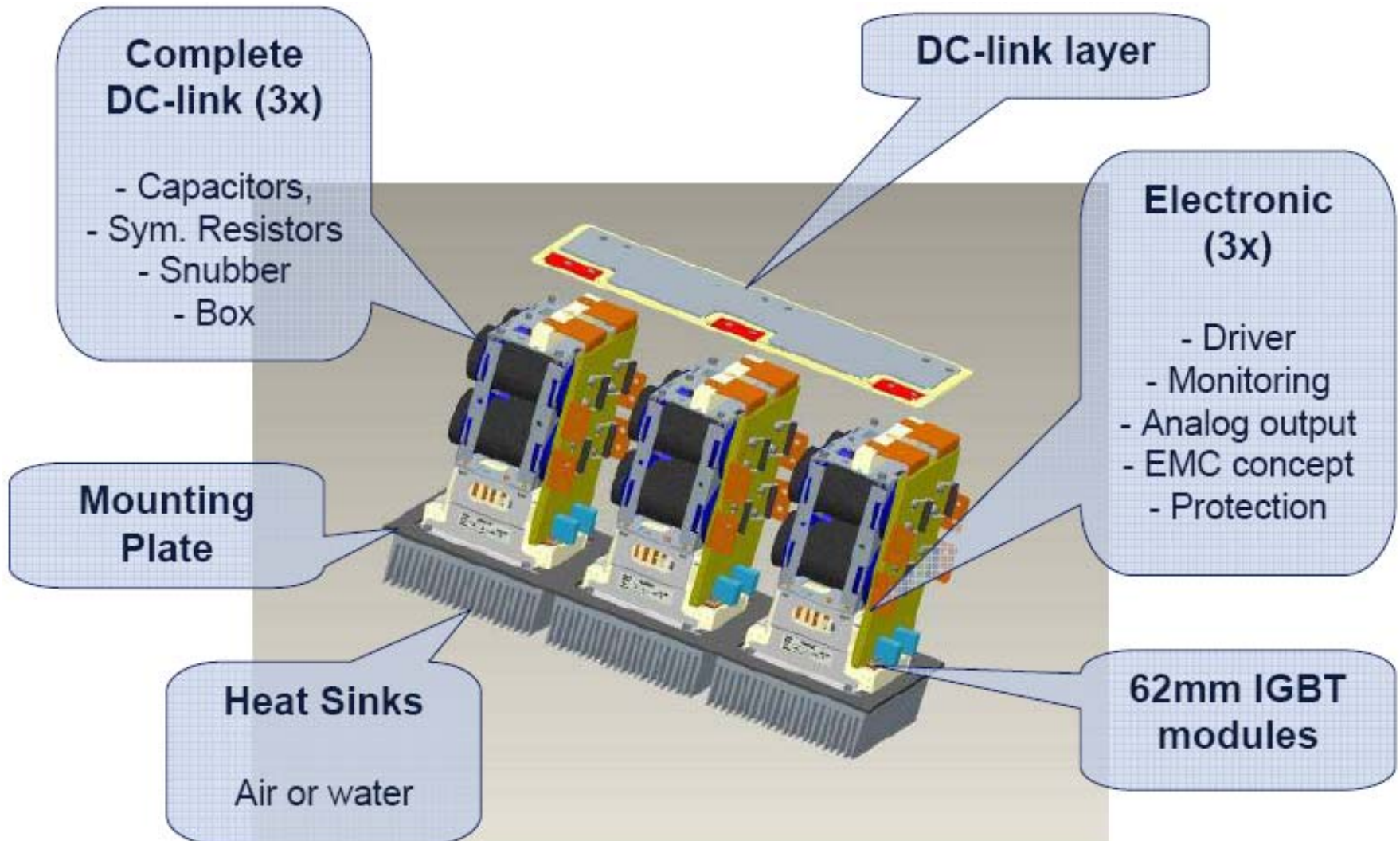


PrimeSTACK™ – Basic Set & Add-on

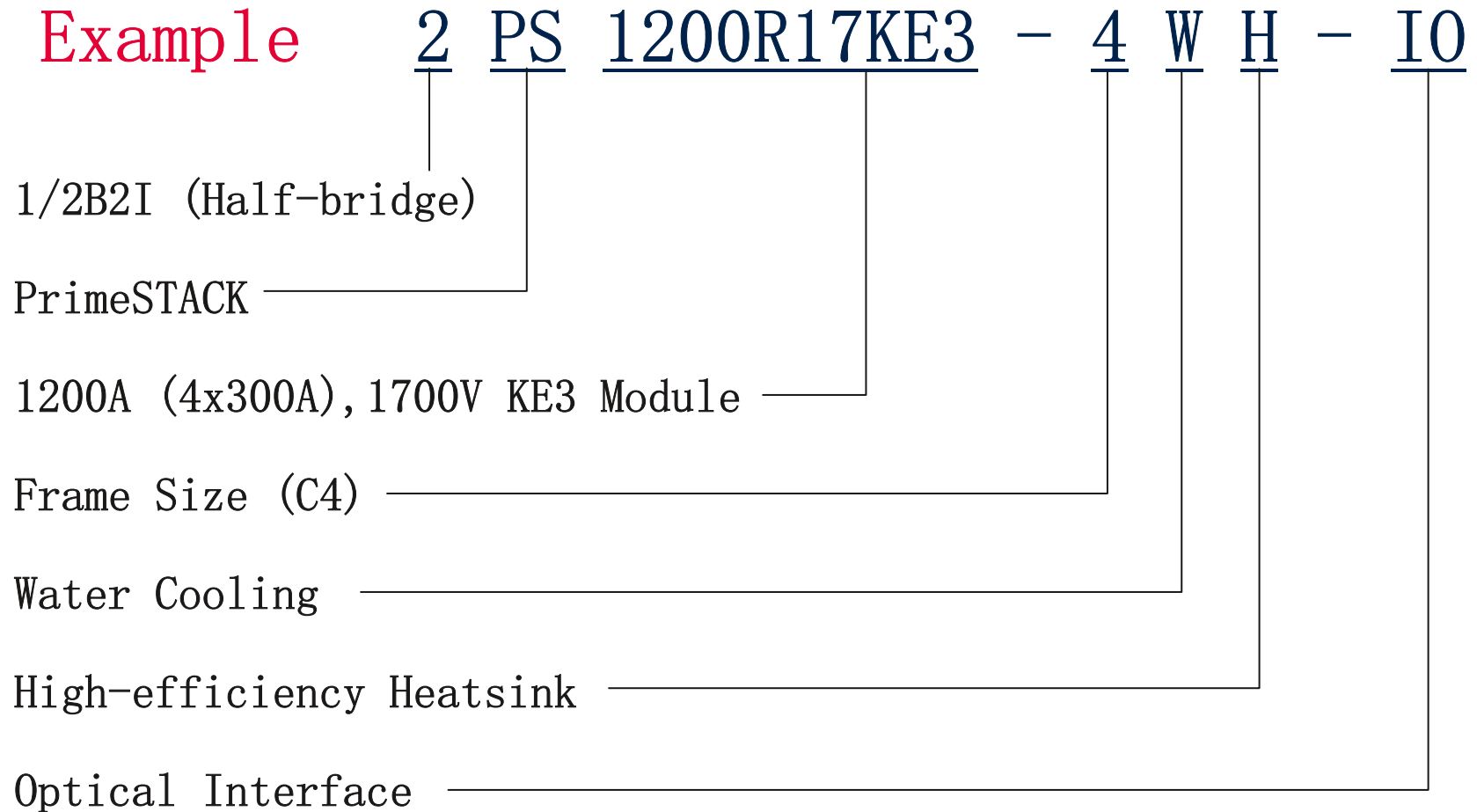






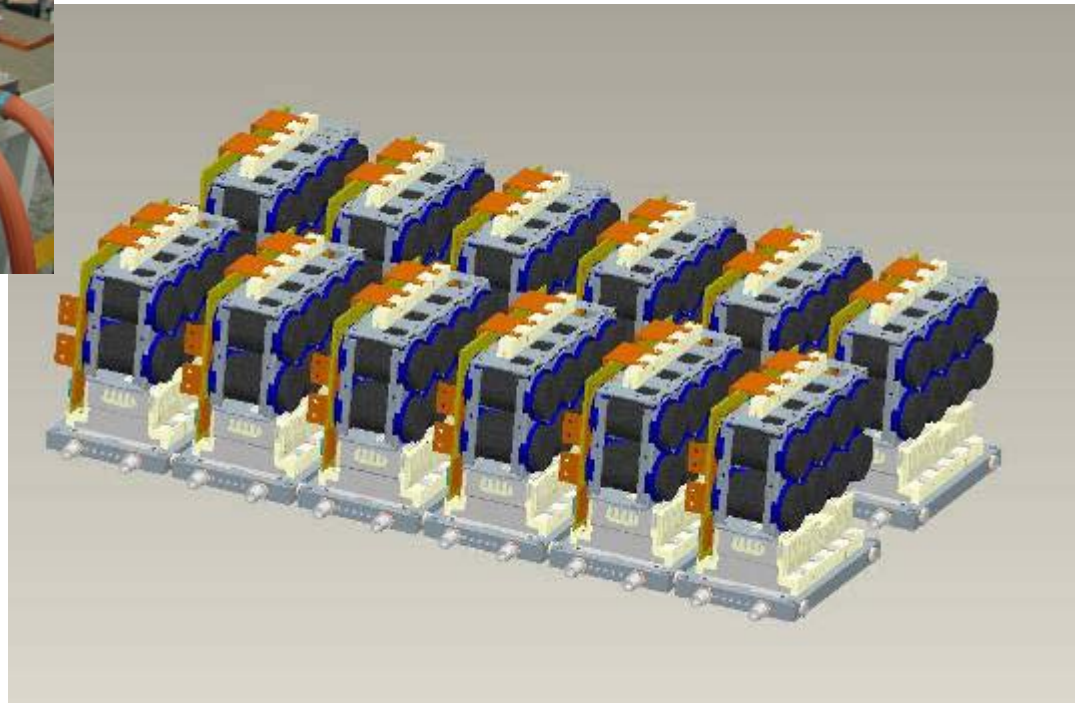


PrimeSTACK™ - Type Designation





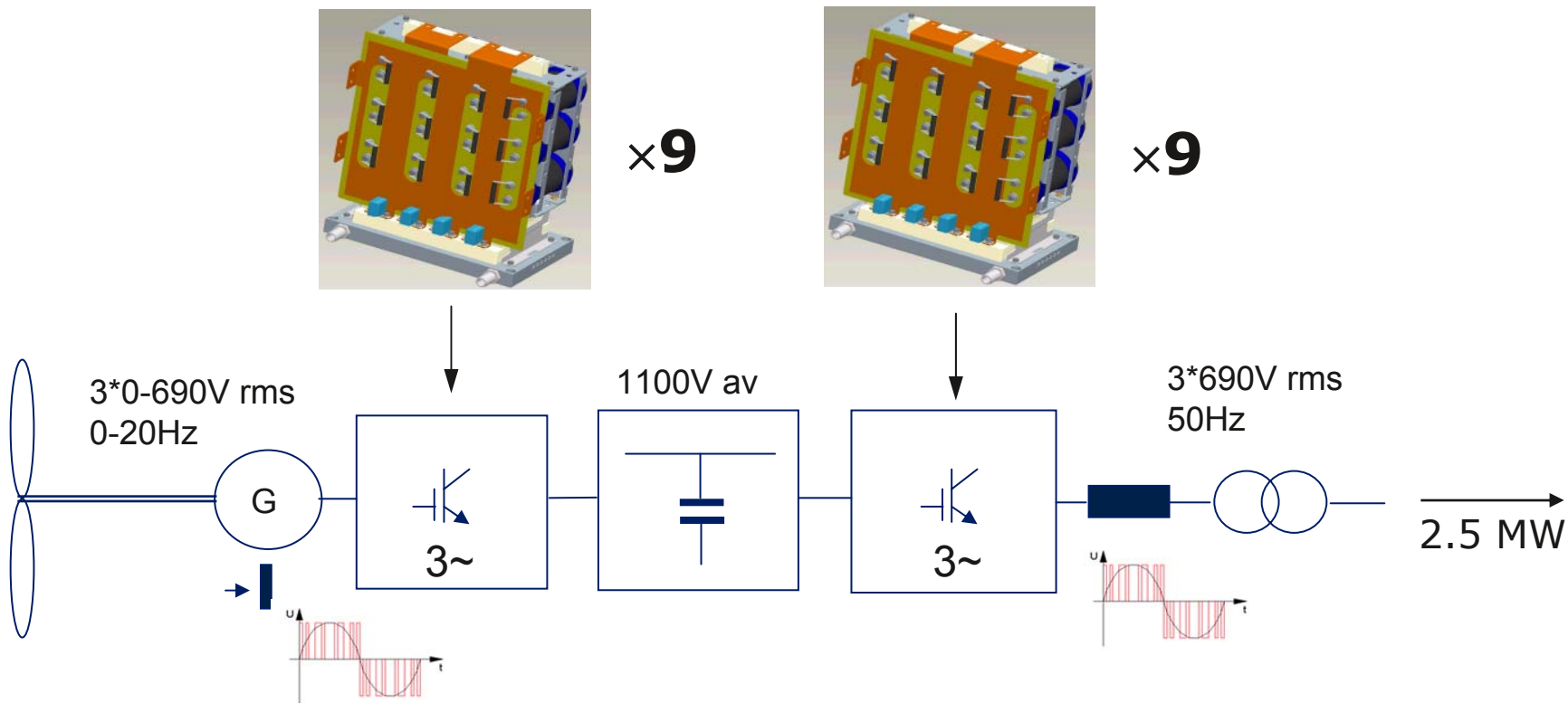
Example



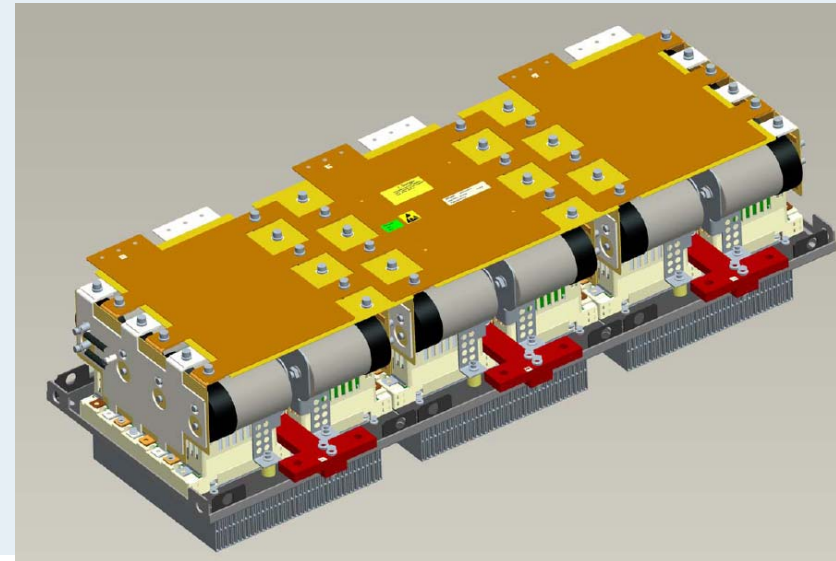
Example: Paralleling of PrimeSTACKs
for 1.5MVA Wind Power Applications

PrimeSTACK方案举例：2.5MW直驱式风电变流器

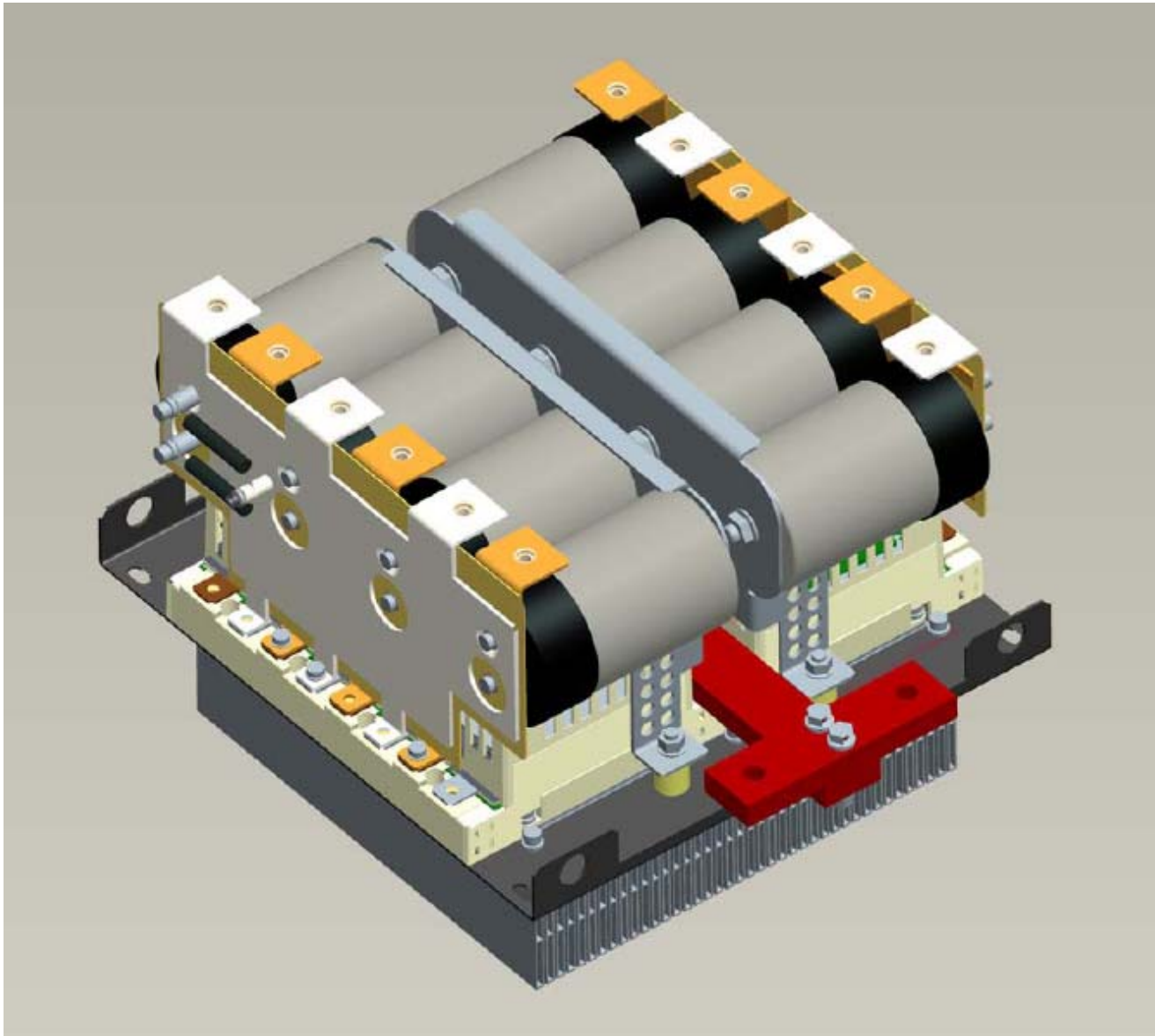
- 套件型号：2PS1200R17KE3-4WH-CxVTIO
- 发电机侧：9个套件，每3个套件并联为一个半桥
- 电网侧：9个套件，每3个套件并联为一个半桥
- 即：一个系统共用18个套件



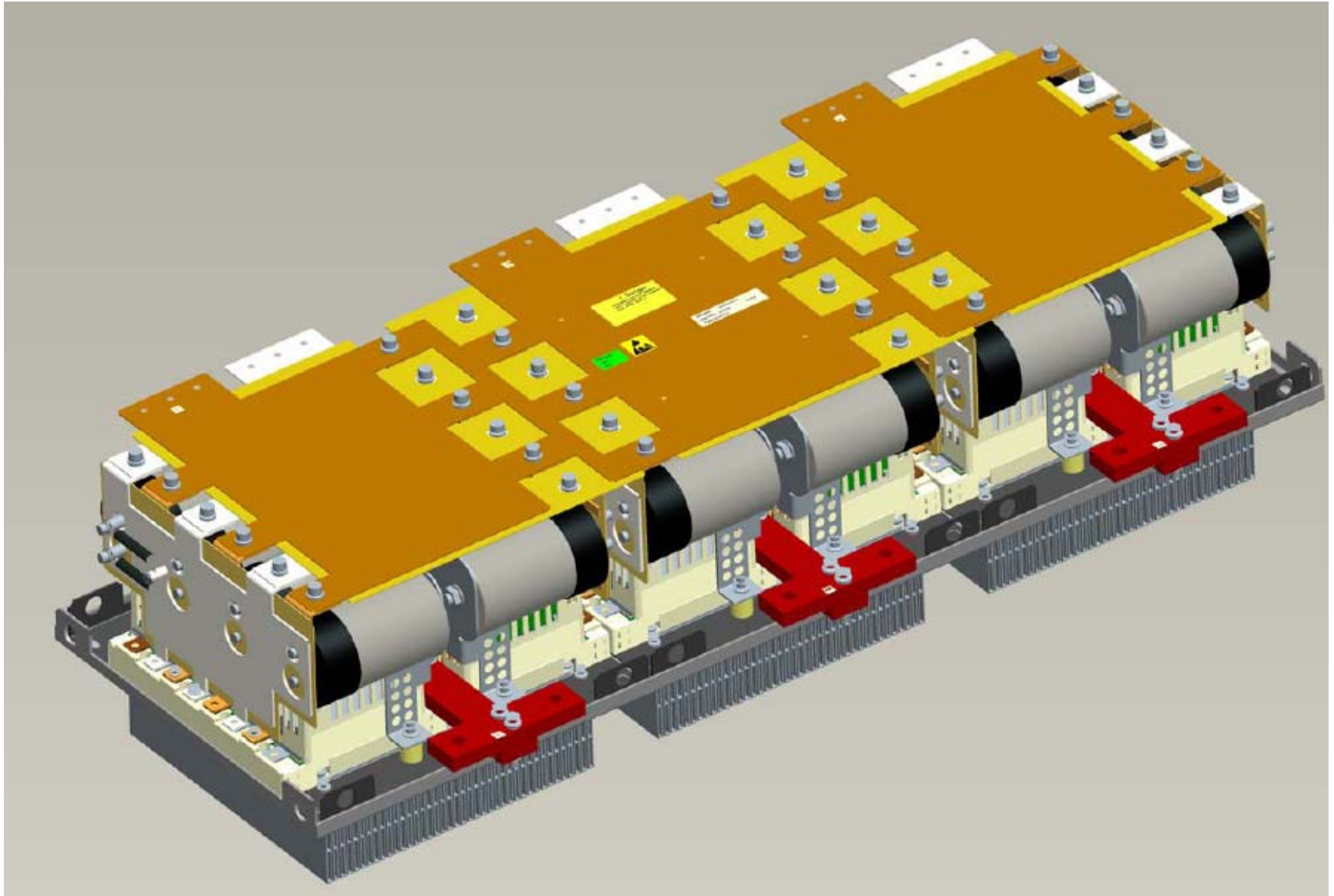
UL approved PrimeSTACK variants for high power applications (solar, drive, wind) (250kW to 1500kW)



PrimeSTACK System for Half-bridge, package "CG" (up to 1470Arms)



Three phase system based on 3x package "CG" (up to 3x1470Arms)



500kW solar application

(Parameter based on 1200V IGBT)



- Type: 3*2PS3200R12KE3-CGHCxVB1B3
- DC Link Voltage: 350 to 900Vav
- AC Voltage: 250 V AC
- AC Current: 3*1470 Arms
- Cooling air temperature: 50°C

- IGBT modules: 24*FF400R12KE3 (62mm)
- DC Link capacitor: 24*415μF/1100V MP
- Current sensor:
- DC link voltage sensor:
- Temperature sensor:
- Driver board: DR240 with EiceDRIVER 2ED300C17

- Dimensions (w*d*h): 1142*468*313mm
- Weight: About 100kg

- UL approved

1500 kW drive application

(Parameter based on 1700V IGBT)

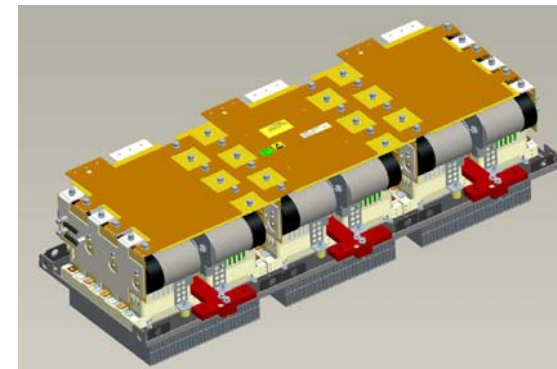


- Type: 3*2PS2400R17KE3-CGHCxVB1B3
- Current: 3*1250 Arms
- Line voltage: 3*690 Vrms
- Apparent power: 1,5 MVA
- DC Link Voltage nom: 975 Vav
- Cooling air temperature: 40°C

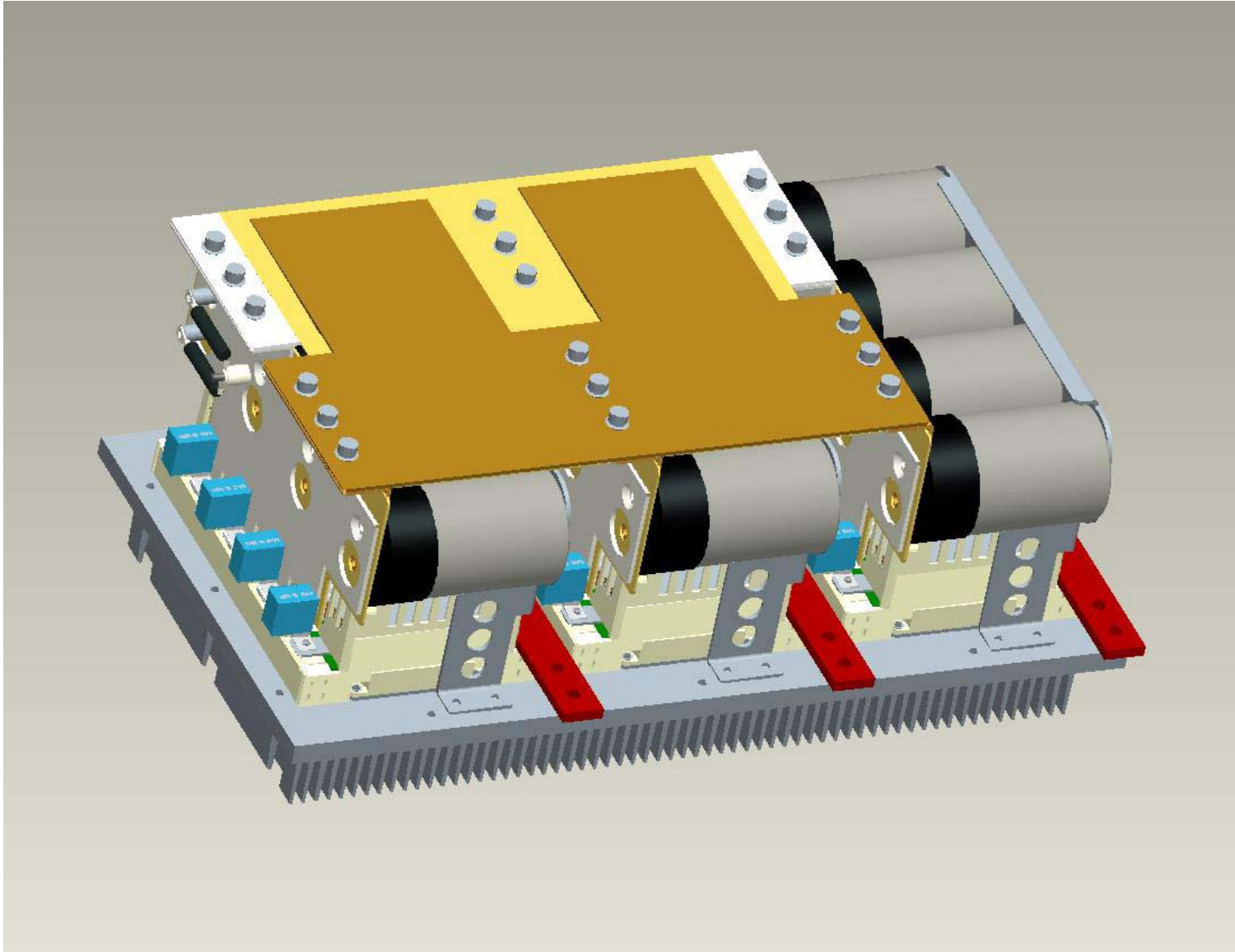
- IGBT modules: 24*FF300R17KE3 (62mm)
- DC Link capacitor: 24*415µF/1100V MP
- Current sensor:
- DC link voltage sensor:
- Temperature sensor:
- Driver board: DR240 with EiceDRIVER 2ED300C17

- Dimensions (w*d*h): 1142*468*313mm
- Weight: About 100kg

- UL approved



PrimeSTACK System based on package "CF" (up to 3*735Arms)



250kW solar application

(Parameter based on 1200V IGBT)

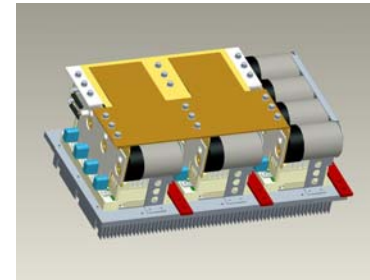


- Type: 6PS1600R12KE3-FGHCxVB1
- DC Link Voltage: 350 to 900Vav
- AC Voltage: 250 V AC
- AC Current: 3*735 Arms
- Cooling air temperature: 50°C

- IGBT modules: 12*FF400R12KE3 (62mm)
- DC Link capacitor: 12*415μF/1100V MP
- Current sensor:
- DC link voltage sensor:
- Temperature sensor:
- Driver board: DR240 with EiceDRIVER 2ED300C17

- Dimensions (w*d*h): 571*468*313mm
- Weight: About 50kg

- UL approved





We commit.
We innovate.
We partner.
We create value.



Never stop thinking