# Technical Information

ModSTACK™ HD **6MS20017E43W38170**

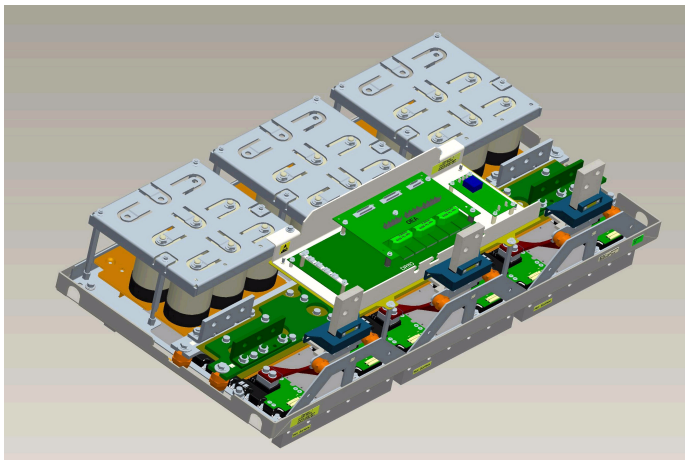
**Preliminary data**

## General information

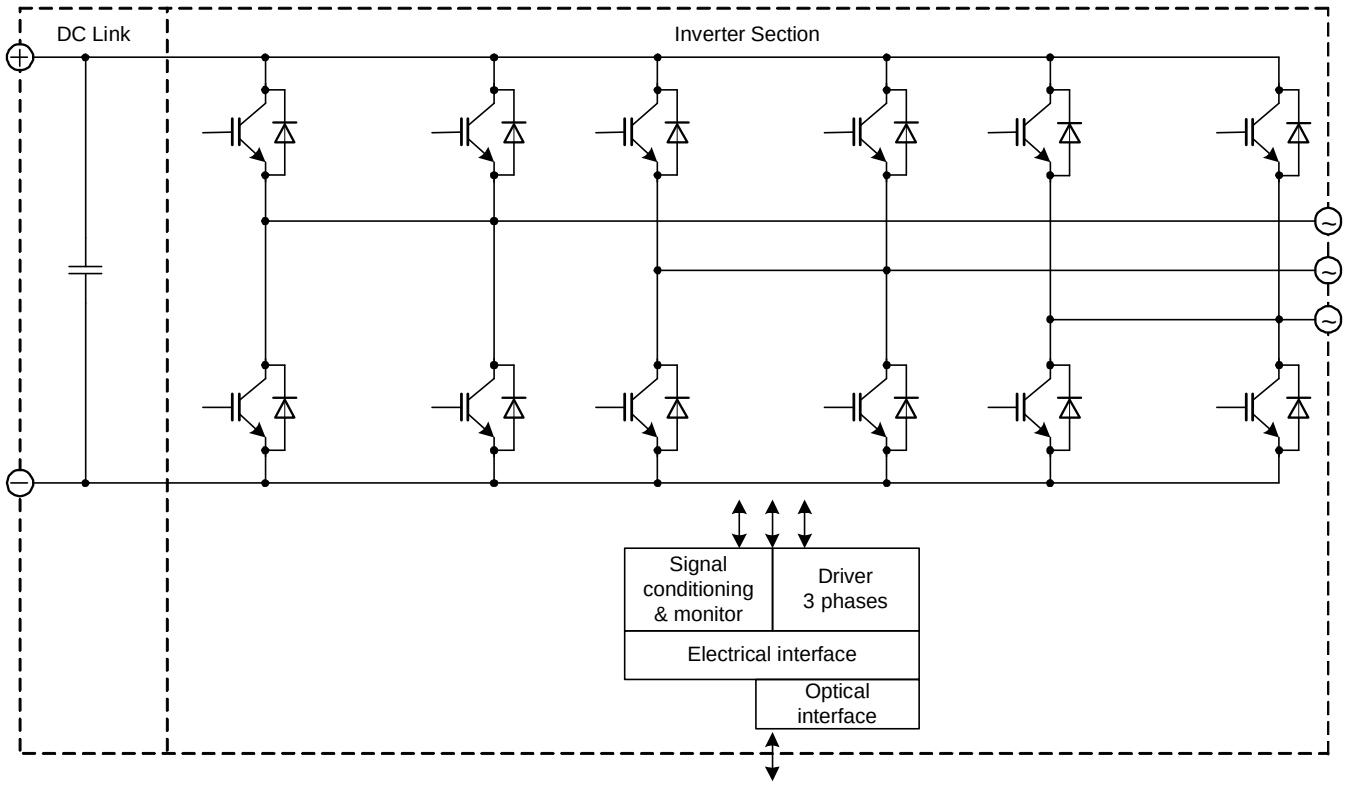
**IGBT Stack for typical voltages of up to 690 $V_{RMS}$**
**Rated output current 1200 $A_{RMS}$**

· High power converter
· Wind power
· Motor drives

· PrimePACK™3 module with integrated NTC
· Extended operational temperature
· Low $V_{cesat}$



| | |
|---|---|
| Topology | B6I |
| Application | Inverter |
| Load type | Resistive, inductive |
| Semiconductor (Inverter Section) | 6x FF1000R17IE4 |
| DC Link | 7.2 mF |
| Heatsink | Water cooled |
| Implemented sensors | Current, voltage, temperature |
| Driver signals IGBT | Optical HFBR-1521;HFBR-2521 |
| Sales - name | 6MS20017E43W38170 |
| SP - No. | SP001036766 |




| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

## Absolute maximum rated values

| | | | | |
|---|---|---|---|---|
| Collector-emitter voltage | IGBT; $T_{vj}$ = 25°C | $V_{CES}$ | 1700 | V |
| Repetitive peak reverse voltage | Diode; $T_{vj}$ = 25°C | $V_{RRM}$ | 1700 | V |
| DC link voltage | | $V_{DC}$ | 1250 | V |
| Insulation management | according to installation height of 2000 m | $V_{line}$ | 690 | $V_{RMS}$ |
| Insulation test voltage | according to EN 50178, f = 50 Hz, t = 1 s | $V_{ISOL}$ | 2.5 | $kV_{RMS}$ |
| Repetitive peak collector current inverter section (IGBT) | $t_p$ = 1 ms | $I_{CRM2}$ | 2500 | A |
| Repetitive peak forward current inverter section (Diode) | $t_p$ = 1 ms | $I_{FRM2}$ | 2500 | A |
| $I^2t$-value inverter section (Diode) | $V_R$ = 0 V, $t_p$ = 10 ms, $T_{vj}$ = 125 °C | $I^2t$ | 252 | $kA^2s$ |
| Continuous current inverter section | | $I_{AC2}$ | 1200 | $A_{RMS}$ |
| Junction temperature | under switching conditions | $T_{vjop}$ | 150 | °C |
| Switching frequency inverter section | | $f_{sw2}$ | 4 | kHz |

**Notes**
Further maximum ratings are specified in the following dedicated sections

## Characteristic values

### DC Link

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Rated voltage | | $V_{DC}$ | | 1100 | 1200 | V |
| Over voltage shutdown | | | | 1250 | | V |
| Capacitor | 1 s, 18 p, rated tol. ±10 % | $C_{DC}$ | | 7.2 | | mF |
| | | type | | Foil | | |
| Maximum ripple current | per device | $I_{ripple}$ | | | 49 | $A_{RMS}$ |
| Balance or discharge resistor | per DC link unit | $R_b$ | | 15.7 | | kΩ |

**Notes**
Operation above 1100 V subject to reduced operating time according to EN 61071

### Inverter Section

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Rated continuous current | $V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 3000 Hz, $T_{inlet}$ = 40°C, $T_j \leq$ 150 °C | $I_{AC}$ | | | 1200 | $A_{RMS}$ |
| Rated continuous current for 150% overload capability | $I_{AC\ 150\%}$ = 1290 $A_{RMS}$, $t_{on\ over}$ = 60 s, $T_j \leq$ 150 °C | $I_{AC\ over1}$ | | | 860 | $A_{RMS}$ |
| Rated continuous current for 150% overload capability | $I_{AC\ 150\%}$ = 1410 $A_{RMS}$, $t_{on\ over}$ = 3 s, $T_j \leq$ 150 °C | $I_{AC\ over2}$ | | | 940 | $A_{RMS}$ |
| Over current shutdown | within 15 µs | $I_{AC\ OC}$ | | 2500 | | $A_{peak}$ |
| Power losses | $I_{AC}$ = 1200 A, $V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, $f_{sw}$ = 3000 Hz, $T_{inlet}$ = 40 °C, $T_j \leq$ 150 °C | $P_{loss}$ | | 19500 | | W |


| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

## Controller interface

| | | | | | | |
|---|---|---|---|---|---|---|
| Driver and interface board | ref. to separate Application Note | | | DR110 | | |
| Optical interface board | ref. to separate Application Note | | | OEA101 | | |
| | | | min. | typ. | max. | |
| Auxiliary voltage | | $V_{aux}$ | 18 | 24 | 30 | V |
| Auxiliary power requirement | $V_{aux}$ = 24 V | $P_{aux}$ | | 40 | | W |
| Digital input level | resistor to GND 1.8 kΩ, capacitor to GND 4 nF, logic high = on, min. 15 mA | $V_{in\ low}$ | 0 | | 4 | V |
| | | $V_{in\ high}$ | 11 | | 15 | V |
| Digital output level | open collector, logic low = no fault, max. 15 mA | $V_{out\ low}$ | 0 | | 1.5 | V |
| | | $V_{out\ high}$ | | 15 | | V |
| Analog current sensor output inverter section | load max 1 mA, @ 1200 $A_{RMS}$ | $V_{IU\ ana2}$ $V_{IV\ ana2}$ $V_{IW\ ana2}$ | 3.7 | 3.8 | 3.9 | V |
| Analog DC link voltage sensor output | load max 1 mA, @ 1100 V | $V_{DC\ ana}$ | 7.7 | 7.9 | 8.1 | V |
| Analog temperature sensor output inverter section (NTC) | load max 1 mA, @$T_{NTC}$ = 71 °C, corresponds to $T_j$ = 148 °C at rated conditions | $V_{Theta\ NTC2}$ | | 8.3 | | V |
| Analog temperature sensor output inverter section (Simulated) | load max 1 mA, @$T_{NTC}$ = 71 °C, corresponds to $T_j$ = 148 °C at rated conditions | $V_{Theta\ sim2}$ | | 8.7 | | V |
| Over temperature shutdown inverter section | | $V_{Error\ OT2}$ | | 9.1 | | V |
| Optical input power | | $P_{opt\ in}$ | | 12 | | µW |
| Optical output power | | $P_{opt\ out}$ | | | 60 | µW |

## System data

| | | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|---|
| EMC robustness | according to IEC 61800-3 at named interfaces | power | $V_{Burst}$ | | 2 | | kV |
| | | control | $V_{Burst}$ | | 1 | | kV |
| | | aux (24V) | $V_{surge}$ | | 1 | | kV |
| Storage temperature | | | $T_{stor}$ | -40 | | 80 | °C |
| Operational ambient temperature | PCB, DC link capacitor, bus bar, excluding cooling medium | | $T_{op\ amb}$ | -25 | | 55 | °C |
| Cooling air velocity | PCB, DC link capacitor, bus bar, standard atmosphere | | $V_{air}$ | 2 | | | m/s |
| Humidity | no condensation | | Rel. F | 0 | | 95 | % |
| Vibration | according to IEC 60721 | | | | | 5 | m/s² |
| Shock | according to IEC 60721 | | | | | 40 | m/s² |
| Protection degree | | | | | IP00 | | |
| Pollution degree | | | | | 2 | | |
| Dimensions | width x depth x height | | | 1090 | 596 | 342 | mm |
| Weight | | | | | 153 | | kg |



| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

## Heatsink water cooled

| | | | min. | typ. | max. | |
|---|---|---|---|---|---|---|
| Water flow | according to coolant specification from Infineon | $\Delta V/\Delta t$ | 45 | | | dm³/min |
| Water pressure | | | | | 8 | bar |
| Water pressure drop | at 45 dm³/min water flow | $\Delta p$ | | 200 | | mbar |
| Coolant inlet temperature | | $T_{inlet}$ | -40 | | 55 | °C |
| Thermal resistance heatsink to ambient | per switch | $R_{th,ha}$ | | 0.038 | | K/W |
| Cooling channel material | | | | Copper | | |

**Notes**
Composition of coolant: Water and 52 vol. % Antifrogen N

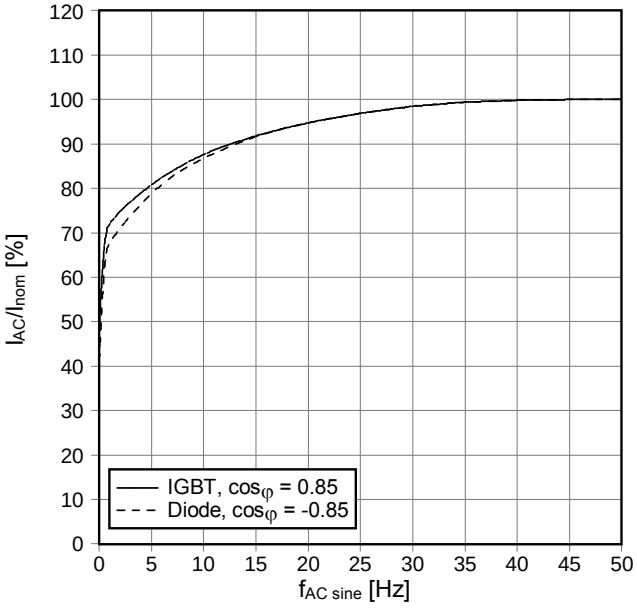
## Overview of optional components

| | Unit 1 | Inverter Section | Unit 3 |
|---|---|---|---|
| Parallel interface board | | | |
| Optical interface board | | × | |
| Voltage sensor | | × | |
| Current sensor | | × | |
| Temperature sensor | | × | |
| Temperature simulation | | × | |
| DC link capacitors | | × | |
| Collector-emitter Active Clamping | | × | |

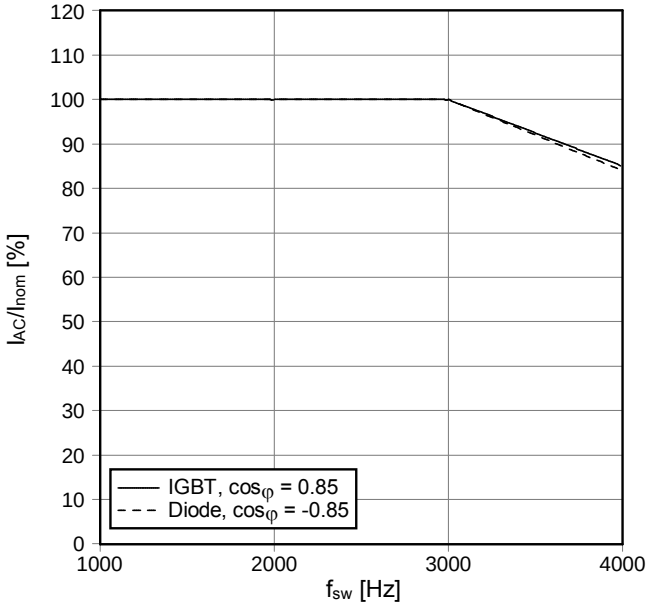
**Notes**
Setting of Active Clamping TVS-Diodes: $V_Z$ = 1280 V

**Preliminary data**

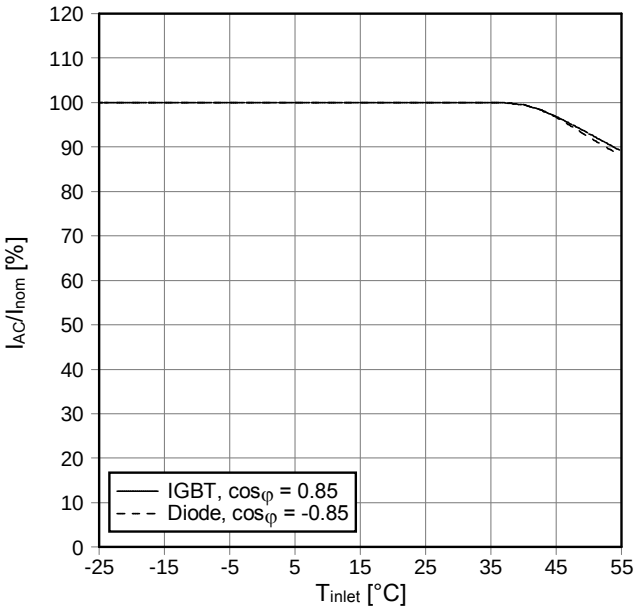
$f_{AC\ sine}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, $f_{sw}$ = 3 kHz, $\cos\varphi$ = ±0.85
$T_{inlet}$ = 40°C and nom. cooling conditions



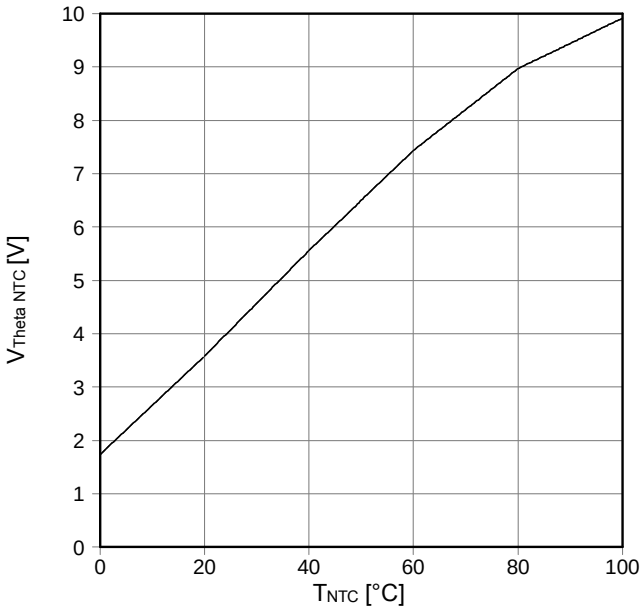

$f_{sw}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, $f_{AC\ sine}$ = 50 Hz, $\cos\varphi$ = ±0.85
$T_{inlet}$ = 40°C and nom. cooling conditions




$T_{inlet}$ - derating curve IGBT (motor), Diode (generator)
$V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, $f_{AC\ sine}$ = 3 kHz, $f_{AC\ sine}$ = 50 Hz
$\cos\varphi$ = ±0.85 and nom. cooling conditions



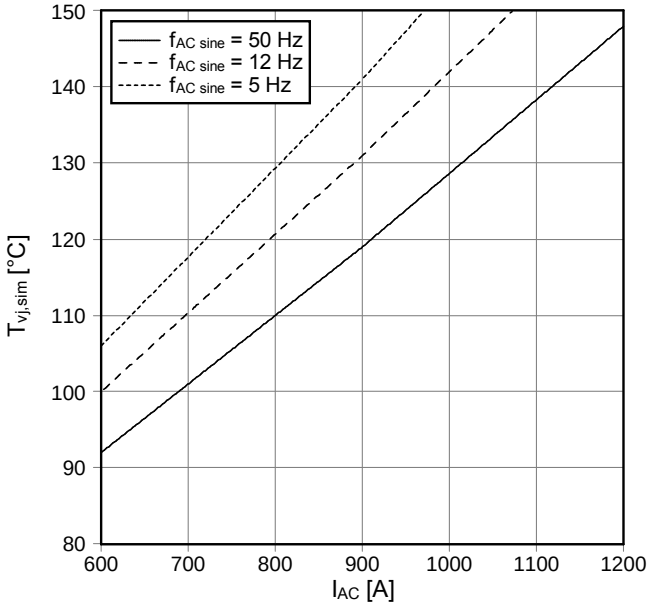

Analog temperature sensor output $V_{Theta\ NTC}$
Sensing NTC of IGBT module



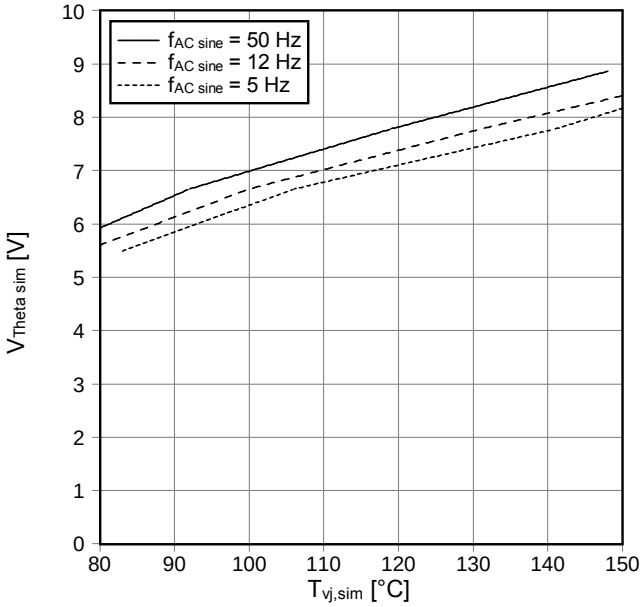

| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

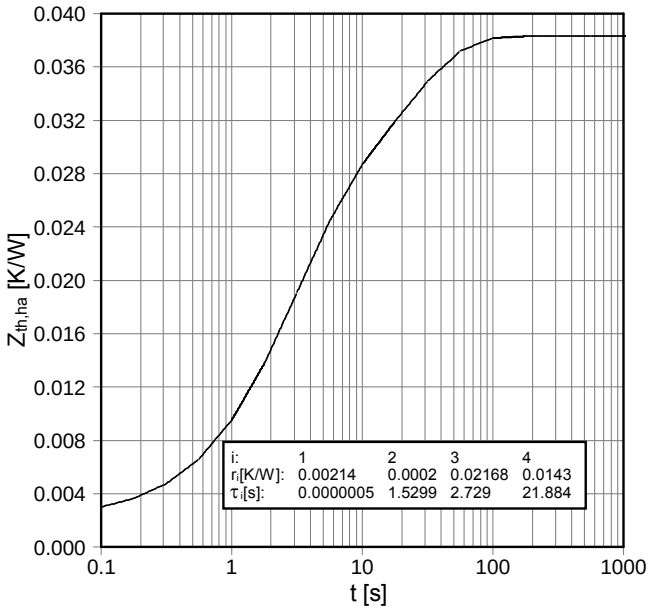
$T_{vj,sim}$ vs. $I_{AC}$ - Simulated junction temperature
$V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, $f_{sw}$ = 3 kHz
$T_{inlet}$ = 40°C and nom. cooling conditions




Analog temperature sensor output $V_{Theta\ sim}$
$V_{DC}$ = 1100 V, $V_{AC}$ = 690 $V_{RMS}$, $f_{sw}$ = 3 kHz,
$T_{inlet}$ = 40°C and nom. cooling conditions



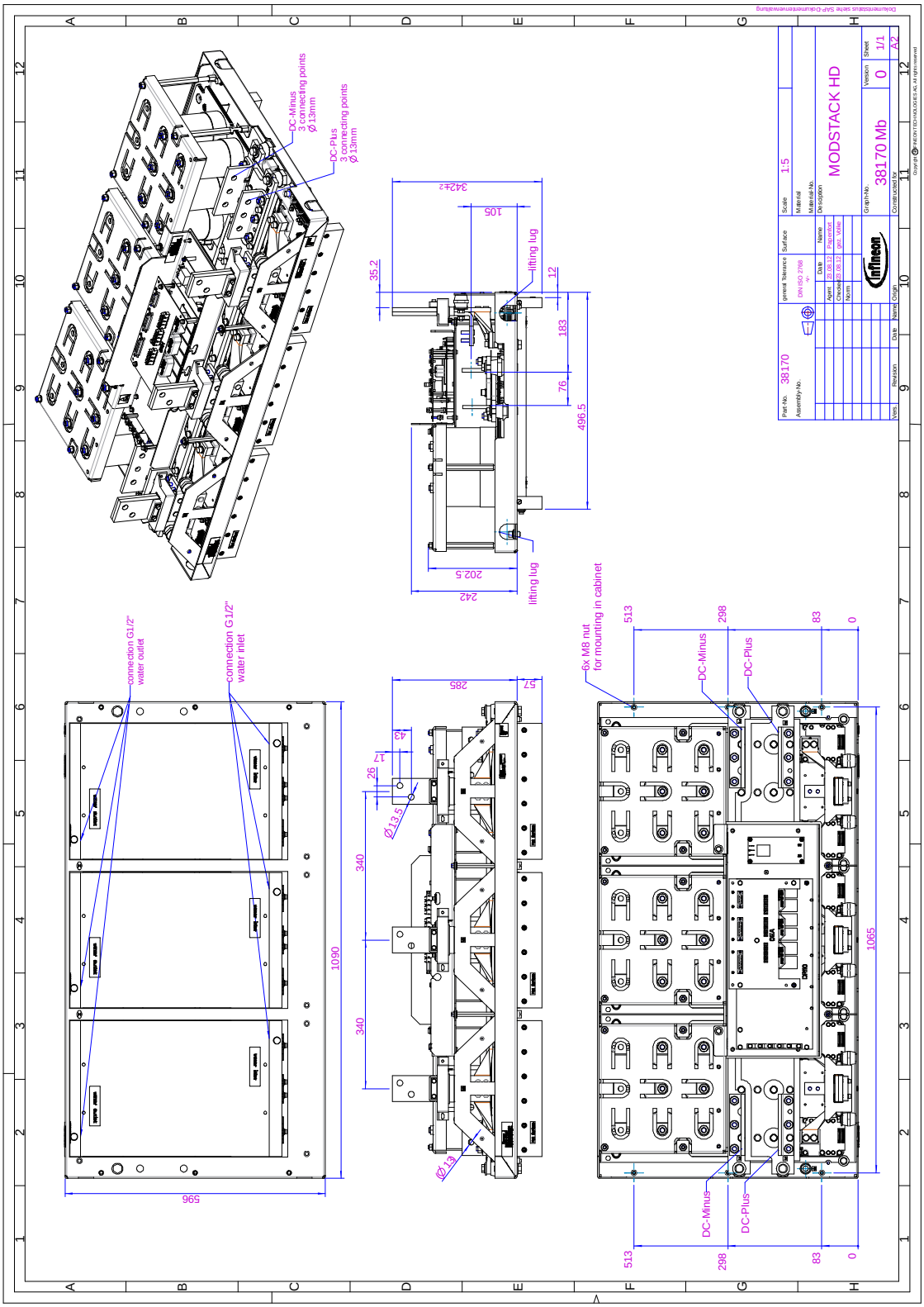

$Z_{th,ha}$ - thermal impedance heatsink to ambient per switch
nom. cooling conditions




| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

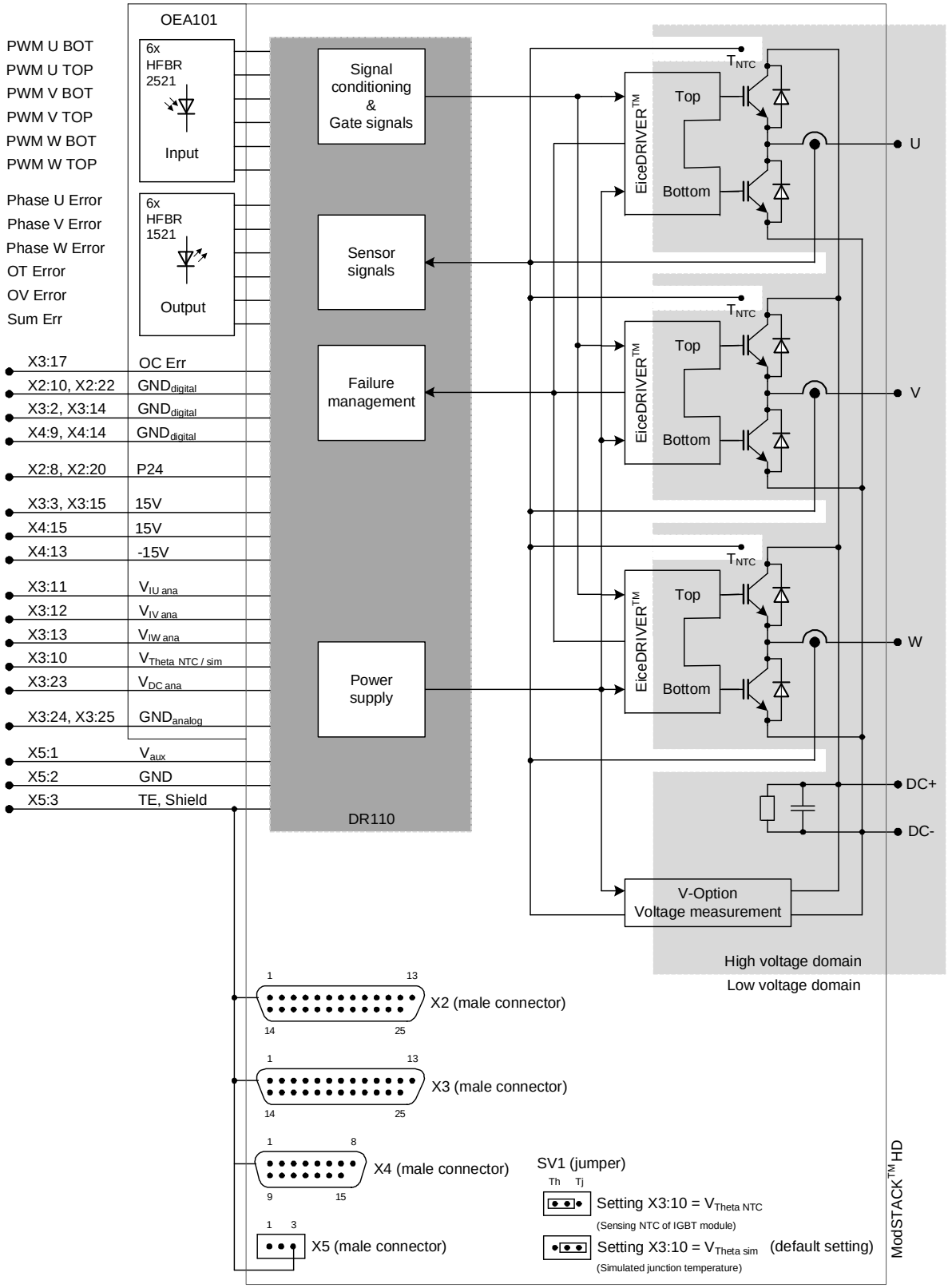
## Mechanical drawing




| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

## Circuit diagram




| | |
|---|---|
| prepared by: OW | date of publication: 2012-08-24 |
| approved by: AR | revision: 2.0 |

**Preliminary data**

## Terms & Conditions of usage

**The data contained in this product data sheet is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.**

**This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.**

**Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.infineon.com, sales&contact). For those that are specifically interested we may provide application notes.**

**Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.**

**Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify. Please note, that for any such applications we urgently recommend**
**- to perform joint Risk and Quality Assessments;**
**- the conclusion of Quality Agreements;**
**- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.**

**If and to the extent necessary, please forward equivalent notices to your customers.**

**Changes of this product data sheet are reserved.**

## Safety Instructions

**Prior to installation and operation, all safety notices and warnings and all warning signs attached to the equipment have to be carefully read. Make sure that all warning signs remain in a legible condition and that missing or damaged signs are replaced. To installation and operation, all safety notices and warnings and all warning signs attached to the equipment have to be carefully read. Make sure that all warning signs remain in a legible condition and that missing or damaged signs are replaced.**