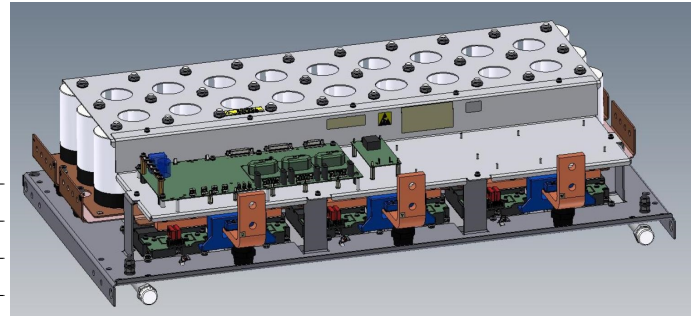


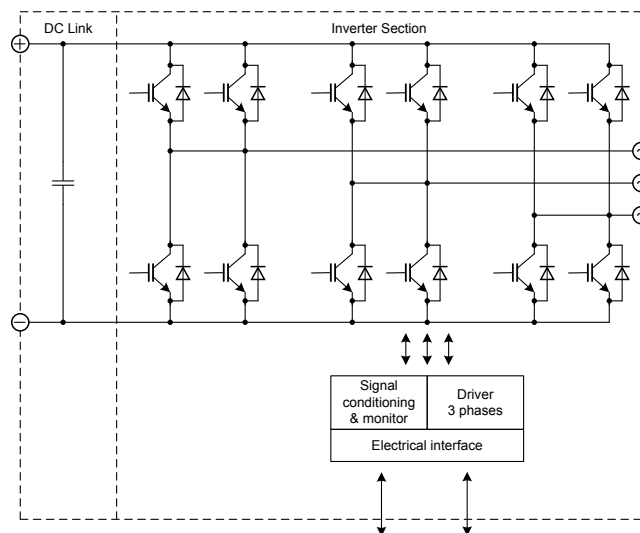
**General information**

**IGBT Stack for typical voltages up to 690 V<sub>RMS</sub>  
Rated output current 1175<sub>RMS</sub>**

- High power converter
- Wind power
- Motor drives
  
- IHM module with IGBT4
- AlSiC baseplate



|                                  |                               |
|----------------------------------|-------------------------------|
| Topology                         | B6I                           |
| Application                      | Inverter                      |
| Load type                        | Resistive, inductive          |
| Semiconductor (Inverter Section) | 6x FF1200R17KP4_B2            |
| DC Link                          | 12 mF                         |
| Heatsink                         | Water cooled                  |
| Implemented sensors              | Current, voltage, temperature |
| Driver signals IGBT              | Electrical                    |
| Sales - name                     | 6MS24017P43W41646             |
| SP - No.                         | SP001420674                   |



|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

Preliminary data

**Absolute maximum rated values**

|                                      |  |            |      |                    |
|--------------------------------------|--|------------|------|--------------------|
| Collector-emitter voltage            | IGBT; $T_{vj} = 25^{\circ}\text{C}$                          | $V_{CES}$  | 1700 | V                  |
| Repetitive peak reverse voltage      | Diode; $T_{vj} = 25^{\circ}\text{C}$                         | $V_{RRM}$  | 1700 | V                  |
| DC link voltage                      | No switching; $t=5\text{s}$ , once a day                     | $V_{DC}$   | 1450 | V                  |
| Insulation management                | according to installation height of 2000 m                   | $V_{line}$ | 690  | $V_{RMS}$          |
| Insulation test voltage              | according to EN 50178, $f = 50\text{ Hz}$ , $t = 5\text{ s}$ | $V_{ISOL}$ | 2.5  | $\text{kV}_{RMS}$  |
| Junction temperature                 | under switching conditions                                   | $T_{vjop}$ | 150  | $^{\circ}\text{C}$ |
| Storage temperature min.             |  | $T_{stor}$ | -40  | $^{\circ}\text{C}$ |
| Storage temperature max.             |  | $T_{stor}$ | 65   | $^{\circ}\text{C}$ |
| Operational ambient temperature min. |  | $T_{amb}$  | -25  | $^{\circ}\text{C}$ |
| Operational ambient temperature max. |  | $T_{amb}$  | 55   | $^{\circ}\text{C}$ |
| Auxiliary voltage                    |  | $V_{aux}$  | 30   | V                  |
| Switching frequency inverter section |  | $f_{sw2}$  | 3.5  | kHz                |

**Notes**

Further maximum ratings are specified in the following dedicated sections

**Characteristic values**

**DC Link**

|                               |  |              | min. | typ. | max. |                  |
|-------------------------------|--|--------------|------|------|------|------------------|
| Rated voltage                 | Continuous mode                            | $V_{DC}$     |      | 1050 |      | V                |
| Over voltage shutdown         | within 150 $\mu\text{s}$                   |              |      | 1300 |      | V                |
| Capacitor                     | 1 s, 30 p, rated tol. $\pm 10\%$           | $C_{DC}$     |      | 12   |      | mF               |
|                               |  | type         | Foil |      |      |                  |
| Maximum ripple current        | per device, $T_{amb} = 55^{\circ}\text{C}$ | $I_{ripple}$ |      |      | 49   | $A_{RMS}$        |
| Balance or discharge resistor | per DC link unit                           | $R_b$        | 6    |      |      | $\text{k}\Omega$ |

**Notes**

Operation above 1100 V subject to reduced operating time according to EN 61071  
Reduce short circuit protection over 1200V

**Inverter Section**

|   |   |                 | min. | typ.  | max. |            |
|---|---|-----------------|------|-------|------|------------|
| Rated continuous current                              | $V_{DC} = 1050\text{ V}$ , $V_{AC} = 690\text{ V}_{RMS}$ , $\cos(\varphi) = 0.9$ ,<br>$f_{AC\ sine} = 50\text{ Hz}$ , $f_{sw} = 2600\text{ Hz}$ , $T_{inlet} = 50^{\circ}\text{C}$                            | $I_{AC}$        |      | 1175  |      | $A_{RMS}$  |
| Rated continuous current for 150% overload capability | $I_{AC\ 150\%} = 1100\text{ A}_{RMS}$ , $t_{on\ over} = 0.01\text{ s}$ , $t_{recovery} = 135\text{ s}$  | $I_{AC\ over1}$ |      |       | 1767 | $A_{RMS}$  |
| Over current shutdown                                 | within 15 $\mu\text{s}$   | $I_{AC\ OC}$    |      | 2500  |      | $A_{peak}$ |
| Power losses  | $I_{AC} = 1175\text{ A}$ , $V_{DC} = 1050\text{ V}$ , $V_{AC} = 690\text{ V}_{RMS}$ ,<br>$\cos(\varphi) = 0.9$ , $f_{AC\ sine} = 50\text{ Hz}$ , $f_{sw} = 2600\text{ Hz}$ , $T_{inlet} = 50^{\circ}\text{C}$ | $P_{loss}$      |      | 14500 |      | W          |

**Inverter Section (specific condition)**

|                             |  |            | min. | typ. | max. |           |
|-----------------------------|--|------------|------|------|------|-----------|
| Specific continuous current | $V_{DC} = 1050\text{ V}$ , $V_{AC} = 690\text{ V}_{RMS}$ , $\cos(\varphi) = -0.9$ ,<br>$f_{AC\ sine} = 12\text{ Hz}$ , $f_{sw} = 2100\text{ Hz}$ , $T_{inlet} = 50^{\circ}\text{C}$ , $T_j \leq 150^{\circ}\text{C}$ | $I_{ACsp}$ |      | 1400 |      | $A_{RMS}$ |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

Preliminary data

**Controller interface**

| Driver and interface board                                    | ref. to separate Application Note   |  | DR112 |      |      |               |
|---|---|--|-------|------|------|---------------|
|   |   |  | min.  | typ. | max. |               |
| Auxiliary voltage   |   | $V_{aux}$  | 18    | 24   | 30   | V             |
| Auxiliary power requirement                                   | $V_{aux} = 24\text{ V}$   | $P_{aux}$  |       | 40   |      | W             |
| Digital input level   | resistor to GND 1.8 k $\Omega$ , 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, @ 1175 $A_{RMS}$   | $V_{IU\ ana2}$<br>$V_{IV\ ana2}$<br>$V_{IW\ ana2}$ |       | 3.6  |      | V             |
| Analog DC link voltage sensor output                          | load max 1 mA, @ 1100 V   | $V_{DC\ ana}$                                      |       | 7.6  |      | V             |
| Analog temperature sensor output inverter section (NTC)       | @ $T_{NTC} = 72\text{ }^{\circ}\text{C}$ , corresponds to $T_j = 138\text{ }^{\circ}\text{C}$ at rated conditions | $V_{Theta\ NTC2}$                                  |       | 8.6  |      | V             |
| Analog temperature sensor output inverter section (Simulated) | @ $T_{NTC} = 72\text{ }^{\circ}\text{C}$ , corresponds to $T_j = 138\text{ }^{\circ}\text{C}$ at rated conditions | $V_{Theta\ sim2}$                                  |       | 8.7  |      | V             |
| Over temperature shutdown inverter section                    | load max 1 mA   | $V_{Error\ OT2}$                                   |       | 10   |      | V             |
| Minimum on time (IGBT)  |   | $t_{on\ min}$                                      | 5     |      |      | $\mu\text{s}$ |
| Minimum off time (IGBT)                                       |   | $t_{off\ min}$                                     | 5     |      |      | $\mu\text{s}$ |

**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         |      | 65   | $^{\circ}\text{C}$ |
| Operational ambient temperature | PCB, DC link capacitor, bus bar, excluding cooling medium | $T_{op\ amb}$ | -25         |      | 55   | $^{\circ}\text{C}$ |
| Cooling air velocity            | PCB, DC link capacitor, bus bar, standard atmosphere      | $V_{air}$     | 2           |      |      | m/s                |
| Humidity                        | no condensation   | Rel. F        | 0           |      | 85   | %                  |
| Vibration                       | according to IEC 60721                                    |               |             |      | 10   | $\text{m/s}^2$     |
| Shock                           | according to IEC 60721                                    |               |             |      | 100  | $\text{m/s}^2$     |
| Protection degree               |   |               | IP00        |      |      |                    |
| Pollution degree                |   |               | 2           |      |      |                    |
| Dimensions                      | width x depth x height                                    |               | 1090        | 625  | 250  | mm                 |
| Weight                          |   |               |             | 90   |      | kg                 |

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |



**Preliminary data**

**Heatsink water cooled**

|  |  |                     | min.     | typ.  | max. |                      |
|--|--|---------------------|----------|-------|------|----------------------|
| Water flow                             | according to coolant specification from Infineon | $\Delta V/\Delta t$ | 35       |       |      | dm <sup>3</sup> /min |
| Water pressure                         |  |                     |          |       | 8    | bar                  |
| Coolant inlet temperature              |  | T <sub>inlet</sub>  | -40      |       | 45   | °C                   |
| Thermal resistance heatsink to ambient | per switch                                       | R <sub>th,ha</sub>  |          | 0.024 |      | K/W                  |
| Cooling channel material               |  |                     | Aluminum |       |      |                      |

**Notes**

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

**Overview of optional components**

|                                   | Unit 1<br>(not installed) | Inverter<br>Section | Unit 3<br>(not installed) |
|-----------------------------------|---------------------------|---------------------|---------------------------|
| Voltage sensor                    |                           | x                   |                           |
| Current sensor                    |                           | x                   |                           |
| Temperature sensor                |                           | x                   |                           |
| Temperature simulation            |                           | x                   |                           |
| DC link capacitors                |                           | x                   |                           |
| Collector-emitter Active Clamping |                           | x                   |                           |

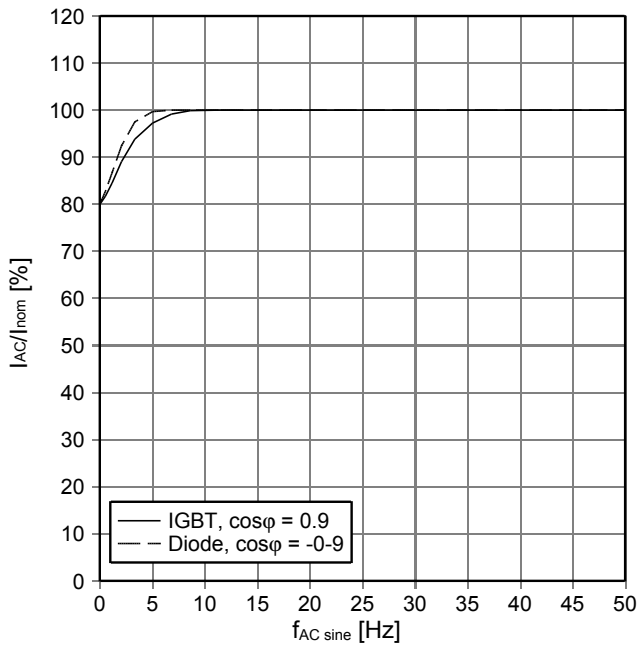
**Notes**

Setting of Active Clamping TVS-Diodes: V<sub>Z</sub> = 1200V/1600V MA111. Reduce short circuit protection above 1200V DC.

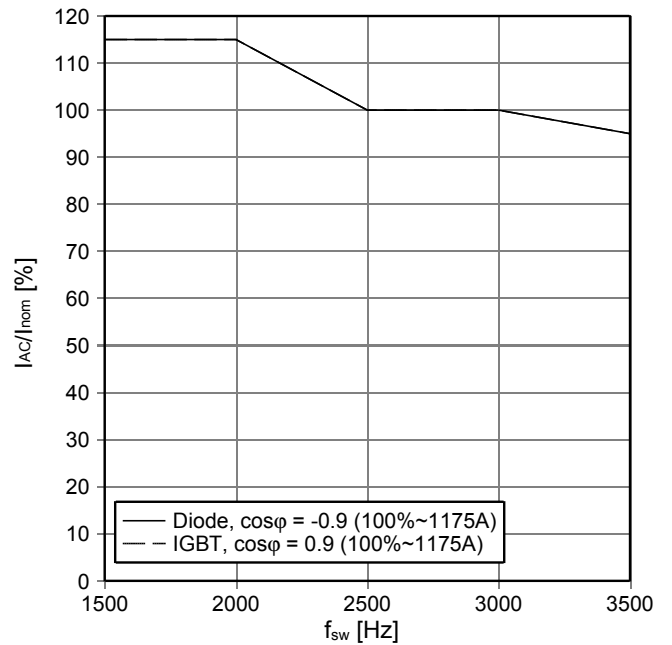
|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

Preliminary data

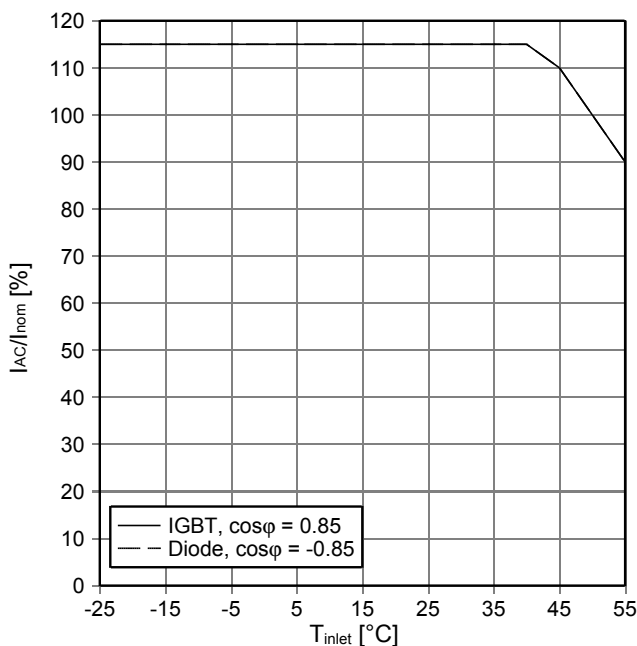
$f_{AC\ sine}$  - derating curve IGBT (motor), Diode (generator)  
 $V_{DC} = 1050\ V$ ,  $V_{AC} = 690\ V$ ,  $f_{sw} = 2.6\ kHz$ ,  $\cos\phi = +/-\ 0.9$   
 $T_{inlet} = 50\ ^\circ C$  and nom. cooling conditions



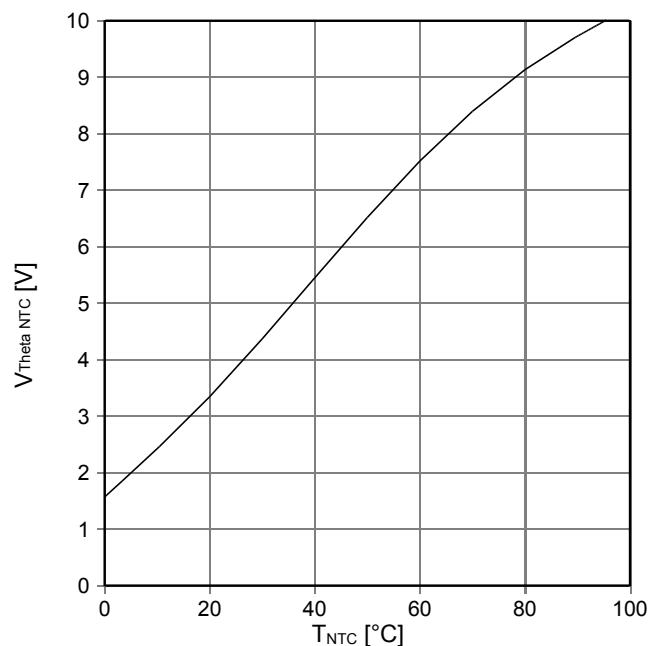
$f_{sw}$  - derating curve IGBT (motor), Diode (generator)  
 $V_{DC} = 1050\ V$ ,  $V_{AC} = 690\ V$ ,  $f_{AC\ sine} = 50/12\ Hz$ ,  $\cos\phi = +/-\ 0.9$   
 $T_{inlet} = 50\ ^\circ C$  and nom. cooling conditions



$T_{inlet}$  - derating curve IGBT (motor), Diode (generator)  
 $V_{DC} = 1050\ V$ ,  $V_{AC} = 690\ V_{RMS}$ ,  $f_{AC\ sine} = 50\ Hz$ ,  $\cos\phi = 0.9$   
 nom. cooling conditions



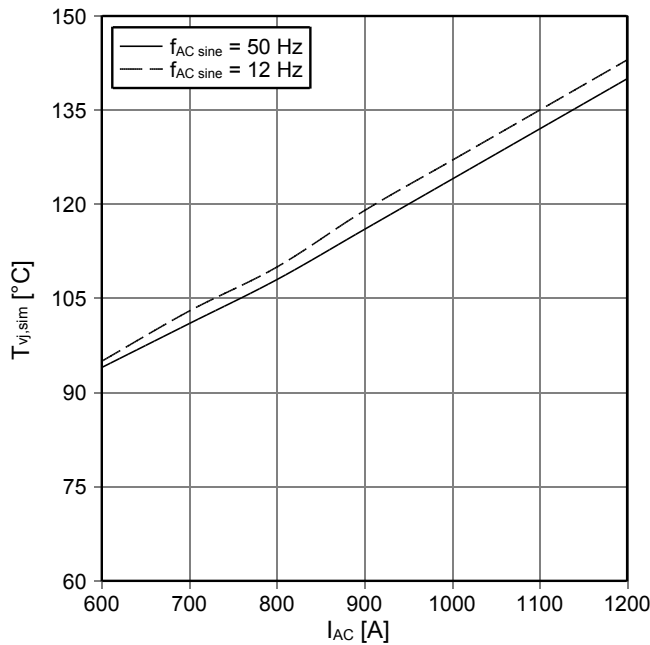
Analog temperature sensor output  $V_{Theta\ NTC}$   
 Sensing NTC of heatsink



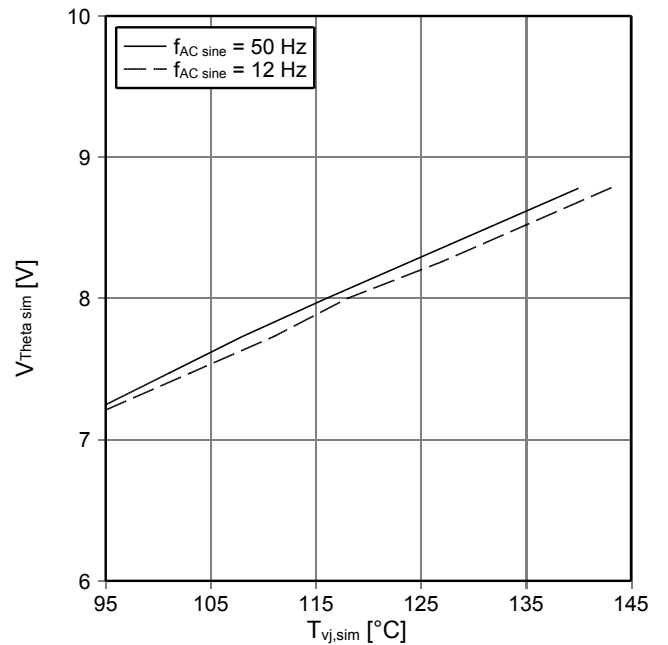
|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

Preliminary data

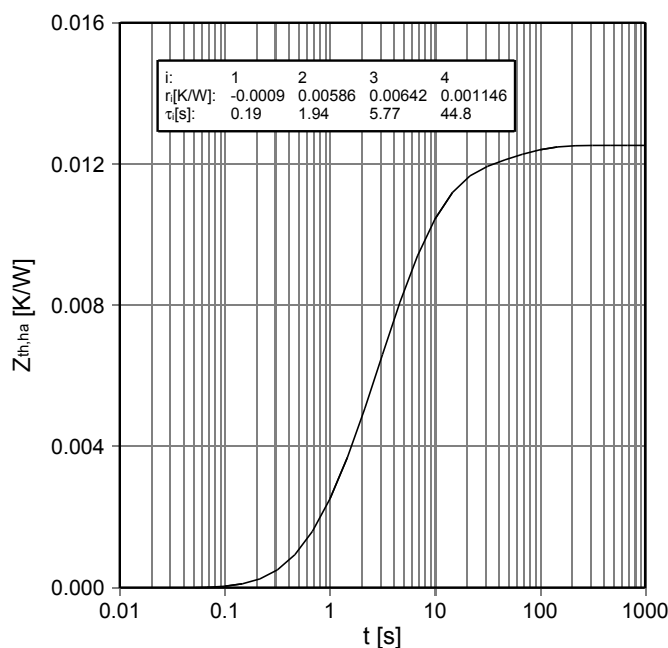
$T_{vj, sim}$  vs.  $I_{AC}$  - Simulated junction temperatur  
 $V_{DC} = 1050\text{ V}$ ,  $V_{AC} = 690\text{ V}_{RMS}$ ,  $f_{sw} = 2.6\text{ kHz}$ ,  
 $T_{inlet} = 50\text{ }^{\circ}\text{C}$  and nom. cooling conditions



Analog temperature sensor output  $V_{Theta\ sim}$   
 $V_{DC} = 1050\text{ V}$ ,  $V_{AC} = 690\text{ V}_{RMS}$ ,  $f_{sw} = 2.6\text{ kHz}$ ,  
 nom. cooling conditions

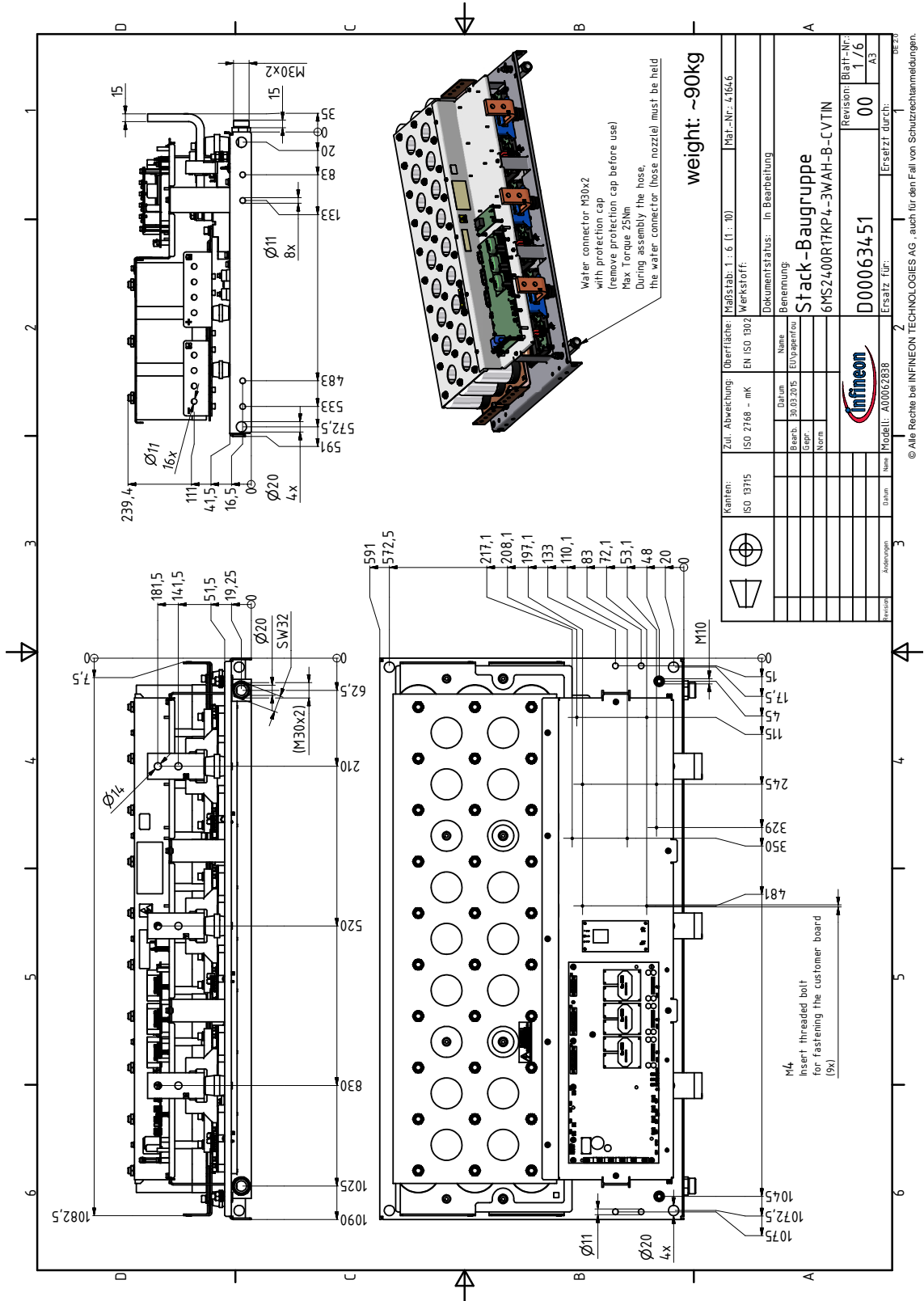


$Z_{th, ha}$  - thermal impedance heatsink to ambient per switch  
 nom. cooling conditions



|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

## Mechanical drawing

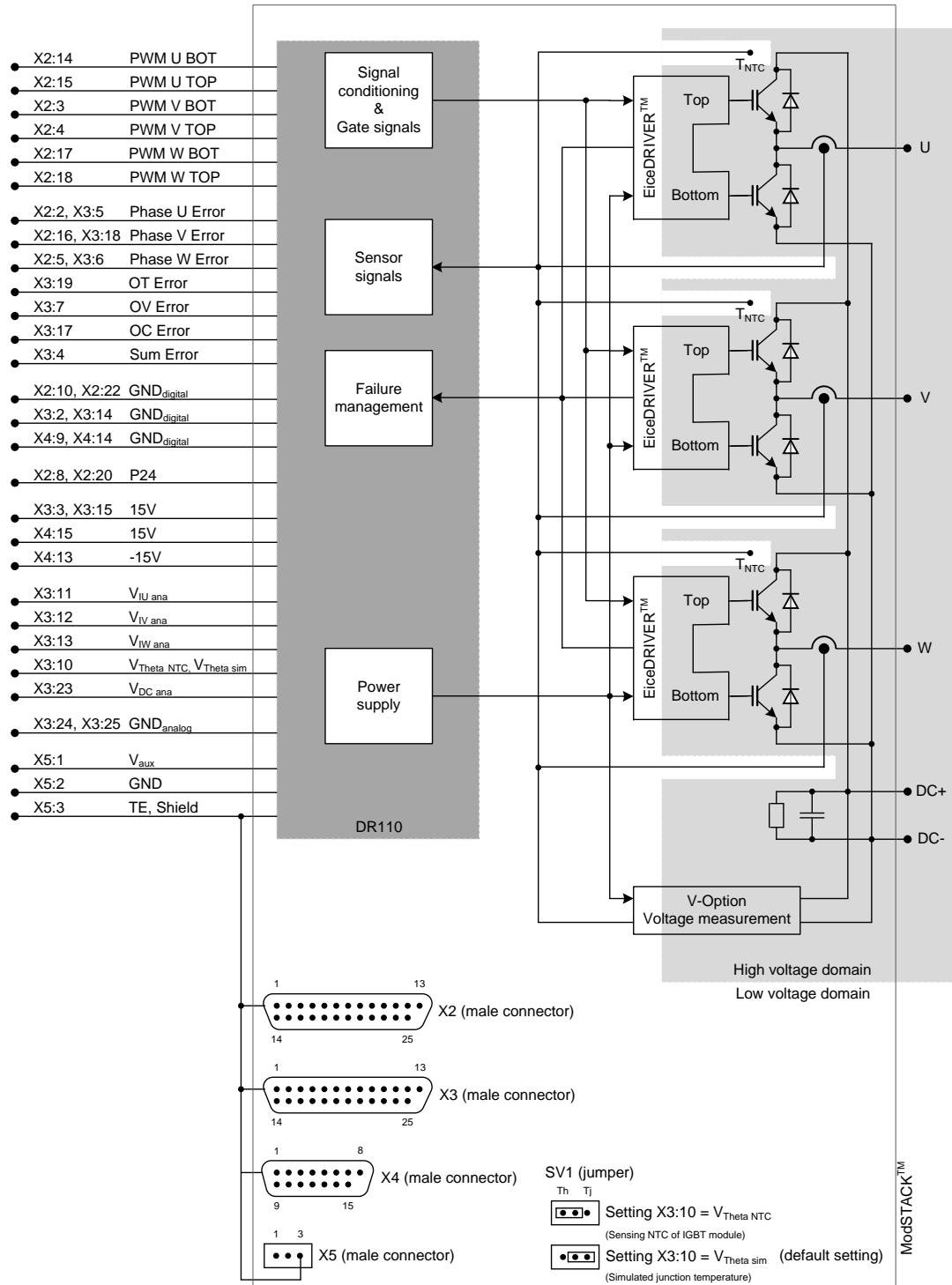


|                   |  |                                |  |                            |  |                                |  |                  |  |
|-------------------|--|--------------------------------|--|----------------------------|--|--------------------------------|--|------------------|--|
| Kanten: ISO 13715 |  | Zul. Abweichung: ISO 2168 - mk |  | Oberfläche: EN ISO 1302    |  | Maßstab: 1 : 6 (1 : 10)        |  | Mat.-Nr.: 4.1646 |  |
| Datum: 30.03.2015 |  | Name: EIVaporteur              |  | Benennung: Stack-Baugruppe |  | Dokumentstatus: in Bearbeitung |  |                  |  |
| Modell: A00062838 |  | Revisions-Nr.: 1/6             |  | 6MS24017P43W41646          |  | D00063451                      |  | Revisi:          |  |
| Ersatz für: 00    |  | Ersatz durch: A3               |  | D00063451                  |  | D00063451                      |  | 00               |  |

© Alle Rechte bei INFINEON TECHNOLOGIES AG, auch für den Fall von Schutzrechtsmeldungen.

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | revision: 2.0                   |

Circuit diagram



|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: YZ | 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](http://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 life 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.

|                 |                                 |
|-----------------|---------------------------------|
| prepared by: OW | date of publication: 2017-06-27 |
| approved by: Z  | revision: 20                    |