

## Key Data

2 x 3 x 400A AC at 500V AC, air cooled

## General Information

Stack with IGBT's, heatsinks, capacitors, drivers and sensors for several inverter applications. These are only technical data! Please read heedful the complete documentation and attend the adopted design environment! Especially the EMC environment and the controller functionality are important.

|                     |      |                                                    |                             |
|---------------------|------|----------------------------------------------------|-----------------------------|
| Topology            |      | DC Link + 2B6I                                     | <p>Unit 1</p> <p>Unit 2</p> |
| Load Type           |      | Resistive, inductive load                          |                             |
| Cooling             |      | Forced air, Fan excluded                           |                             |
| Target Application  |      | Solar                                              |                             |
| Extra               |      | Available in Master [M] or Slave [S] Configuration |                             |
| Driver core         |      | Scale Driver                                       |                             |
| Monitors            |      | Current-, Voltage-, Temperature-Monitoring         |                             |
| Module (Unit1)      |      | n.a.                                               |                             |
| Module (Unit2)      | IGBT | 6x FF800R12KL4C                                    |                             |
| Interface           |      | Electrical, opt. optical                           |                             |
| Standards           |      | EN50178, UL94, prepared for UL508C                 |                             |
| Product ID (eupec)  |      | Master 24967<br>Slave 24969                        |                             |
| Drawing No.         |      | 38000020_MB                                        |                             |
| Circuit Diagram No. |      | 57000002                                           |                             |

## Electrical Data

|                               | Parameter                              |               | Min. | Typical | Max. |      |
|-------------------------------|----------------------------------------|---------------|------|---------|------|------|
| Dedicated Line Voltage        | For Isolation Management               | VLine         |      | 500     |      | VRMS |
| DC Link Voltage               |                                        | VDC           | 275  | 675     | 880  | Vav  |
| DC Link Over Voltage Shutdown | Within 100μs                           |               |      | VDCmax  |      | V    |
| DC Link Current               | At IUnit2, VUnit2, cos φUnit2          | IDCLink Input | 800  | 890     |      | Aav  |
| Voltage Unit1                 |                                        | VUnit1        |      | -       |      | VRMS |
| Continuous Current Unit1      | ϑ=ϑair_inlet                           | IUnit1        |      |         | -    | ARMS |
| Short-time Current Unit1      | 10s, every 180s, initial load = IUnit1 | IUnit1_10     |      |         | -    | ARMS |

|                                     |                                                                                                  |              |        |      |                |       |
|-------------------------------------|--------------------------------------------------------------------------------------------------|--------------|--------|------|----------------|-------|
| Pulse Current Unit1                 | Sine half wave 20ms                                                                              |              |        |      | -              | Apeak |
| DC Current at Unit1                 | No rotating field,<br>θ=θair_inlet,                                                              | IUnit1_DC    |        |      | -              | Aav   |
| Over Current Shutdown Unit1         | Percentage of IUnit1.<br>within 15μs                                                             |              |        | -    |                | %     |
| Switching Freq. Unit1               |                                                                                                  | fsw1         |        |      | -              | Hz    |
| Power Losses Unit1                  | V=Vunit1_min,<br>I=IUnit1, fsw=fsw1                                                              | Ploss1       |        | -    |                | W     |
| Voltage Unit2                       | Depending on<br>Controller                                                                       | VUnit2       |        | 500  | 550            | VRMS  |
| Displacement factor                 |                                                                                                  | cos_φUnit2   | -0,9   |      | +0,9           |       |
| Continuous Current Unit2            | θ=θair_inlet,<br>θchip <= 125°C<br>fUnit2>5Hz<br>Both B6I connected in<br>parallel (1U1 ->2U1..) | IUnit2       |        |      | 800            | ARMS  |
| Short-time Current Unit2            | θwater_inlet<=40°C,<br>10s, every 180s,<br>initial load = IUnit2                                 | IUnit2_10    |        |      | 960            | ARMS  |
| Pulse Current Unit2                 | Sine half wave 20ms,<br>starting from IUnit2.                                                    | IUnit2peak   |        |      | -              | Apeak |
| DC Current at Unit2                 | No rotating field,<br>θ=θair_inlet,                                                              | IUnit2_DC    |        |      | 0,4*<br>IUnit2 | ADC   |
| Over Current Shutdown Unit2         | Percentage of IUnit2.<br>within 15μs                                                             |              |        | 125  |                | %     |
| Switching Freq. Unit2               |                                                                                                  | fsw2         |        |      | 3000           | Hz    |
| Power Losses Unit2                  | I=IUnit2, fsw=fsw2                                                                               | Ploss2       |        | 6521 |                | W     |
| Power Losses (PCB<br>and Capacitor) |                                                                                                  | Ploss_aux    |        |      | 400            | W     |
| Filter resistors at<br>Output Unit2 | Applicable for Sine<br>wave filters (damping,<br>optionally)                                     | RFilter      |        | -    |                | Ohm   |
|                                     |                                                                                                  | PRFilter     |        | -    |                | Watt  |
| Auxiliary Voltage                   |                                                                                                  | Vaux         | 18     | 24   | 30             | Vav   |
| Auxiliary Power<br>Demand           | Vaux=24 Vav, to feed<br>with B6U                                                                 | Paux         | 80     |      |                | W     |
| EMC Test                            | According<br>EN61800-3<br>at named<br>interfaces                                                 | Power        | VBurst | 2    |                | kV    |
|                                     |                                                                                                  | Control      | VBurst | 1    |                |       |
|                                     |                                                                                                  | Aux<br>(24V) | VSurge | 1    |                | kV    |
| Insulation Test Voltage             | According EN50178<br>f=50Hz, t=1min                                                              | Visol        | 1,8    |      |                | kVRMS |

### Important Component Data

|                   |                      |      |       |      |  |      |
|-------------------|----------------------|------|-------|------|--|------|
| DC Link Capacitor |                      | CDC  |       | 23,5 |  | mF   |
| DC Link Capacitor |                      | Type | Elcap |      |  |      |
| Capacitor Design  | Load cycle for: Wind | LTD  |       | -    |  | Year |

|                                   |                                                                                                                |     |  |        |  |      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------|-----|--|--------|--|------|
| Lifetime<br>(eupec approximation) | Load cycle for: Solar                                                                                          | LTD |  | t.b.d. |  | Year |
|                                   | Load cycle for:<br>Industrial Drive<br>( $\vartheta_{air}=35^{\circ}\text{C}$ , $I=0,8$ ,<br>Duration=24h/Day) | LTD |  | -      |  | Year |

### Requirements to the Power Source

|                                                  |                                                          |       |  |    |  |               |
|--------------------------------------------------|----------------------------------------------------------|-------|--|----|--|---------------|
| Assumed Inductance<br>Of Feeding Power<br>Source | (Necessary inductance<br>not included, feeded<br>by B6U) | LFeed |  | 80 |  | $\mu\text{H}$ |
|--------------------------------------------------|----------------------------------------------------------|-------|--|----|--|---------------|

### Fan Data (requirements when not implemented)

|                  |         |                     |                                      |      |  |      |
|------------------|---------|---------------------|--------------------------------------|------|--|------|
| Fan Type         | Assumed |                     | 2pcs Ziehl-Abegg RF22P-<br>2DK.3F.1R |      |  |      |
| Fan Voltage      |         | VFan                |                                      | 400  |  | VRMS |
| Fan Frequency    |         | fFan                |                                      | 50   |  | Hz   |
| Fan Current      |         | IFan                |                                      | 1,95 |  | ARMS |
| Fan Air Pressure | Assumed | $\Delta p_{AirFan}$ |                                      | 700  |  | Pa   |

### Controller Interface Data

|                                  |                                                      |                   |        |   |    |               |
|----------------------------------|------------------------------------------------------|-------------------|--------|---|----|---------------|
| Driver                           | See Data Sheets                                      | PCB               | TR10x  |   |    |               |
| Paralleling Interface            | Master (only first B6I)                              | PCB               | SAD101 |   |    |               |
|                                  | Slave                                                |                   | -      |   |    |               |
|                                  | See Data Sheet                                       |                   |        |   |    |               |
| Optical Interface                | Master (only first B6I)<br>(optional)                | PCB               | OEA101 |   |    |               |
|                                  | Slave                                                |                   | -      |   |    |               |
|                                  | See Data Sheet                                       |                   |        |   |    |               |
| Digital Input Level              | Resistor to Gnd (1,8k)<br>High = on<br>min 15mA      | Vin               | 0      |   | 15 | V             |
| Digital Output Level             | Open collector<br>Low = ok<br>max 15mA               | Vout              | 0      |   | 15 | V             |
| Analog Current<br>Outputs Unit1  | Load max 1mA<br>at IUnit1                            |                   |        | - |    | V             |
| Analog Current<br>Outputs Unit2  | Load max 1mA<br>at IUnit2                            |                   |        | 4 |    | V             |
| Analog DC Link<br>Voltage Output | Load max 1 mA<br>At VDCmax                           | VDCout            |        | 9 |    | V             |
| Analog Temperature<br>Out        | Load max 1mA<br>At $\vartheta_j=125^{\circ}\text{C}$ | V $\vartheta$ out |        | 9 |    | V             |
| Optical Input Level              | optionally                                           |                   | 12     |   |    | $\mu\text{W}$ |
| Optical Output Level             | optionally                                           |                   |        |   | 60 | $\mu\text{W}$ |

## Requirements to the Controller

|                                     |                                                              |         |                                                                                   |  |    |    |
|-------------------------------------|--------------------------------------------------------------|---------|-----------------------------------------------------------------------------------|--|----|----|
| EMC Protection                      | According EN61800-3 at auxiliary power and control interface |         | 1                                                                                 |  |    | kV |
| EMC Environment                     |                                                              |         | Shielding concept with TE (True Earth) separated from PE, HF conform installation |  |    |    |
| Drive Pulse Time                    |                                                              | ton_min | 10                                                                                |  |    | μs |
| Block out Time                      |                                                              | tpause  | 10                                                                                |  |    | μs |
| Over Voltage Shutdown Reaction Time | After over voltage message by ModSTACK interface             |         |                                                                                   |  | 50 | μs |
| Over Current Shutdown Reaction Time | After over current message by ModSTACK interface             |         |                                                                                   |  | 10 | μs |

## Mechanical Data

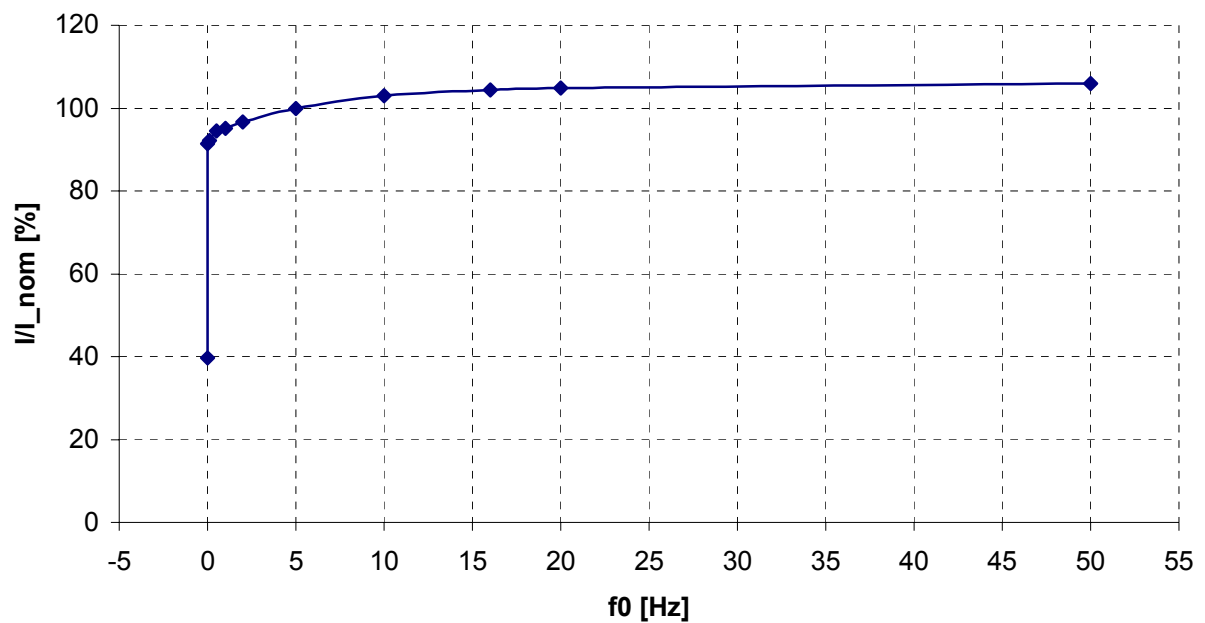
|                                                 |                                                                                                       |              |         |      |      |       |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------|---------|------|------|-------|
| Air Velocity                                    | θAir=20°C<br>Pair=1013 hPa<br>Dry- and dustfree, measured outside of heatsink.<br>According DIN 41882 | vAir         |         | 12   |      | m/s   |
| Air Flow/ heatsink                              |                                                                                                       | dV/dtAir     | -       | 2200 |      | m³/h  |
| Air Pressure Drop/ heatsink                     |                                                                                                       | ΔpAir        |         | 700  |      | Pa    |
| Water Flow/ heatsink                            | According Coolingwater Specification from eupec for copper tubes                                      | dV/dt Water  | -       |      |      | l/min |
| Water Pressure Drop/ heatsink                   |                                                                                                       | ΔpWater      |         | -    |      | Pa    |
| Water connection                                |                                                                                                       |              |         |      |      |       |
| Dimensions                                      | Width x Depth x Height                                                                                |              | 1090    | 600  | 305  | mm    |
| Mass                                            | Approximation                                                                                         |              |         | 101  |      | kg    |
| Storage Temperature Range                       |                                                                                                       | θstor        | -40     |      | +65  | °C    |
| Operating Temperature range (PCB and Capacitor) | Minimal 0 °C for optional optical interface                                                           | θop          | -25 (0) |      | +55  | °C    |
| Cooling Air Inlet Temperature (Heatsink)        |                                                                                                       | θair_inlet   | -25     |      | +40  | °C    |
|                                                 | Heatsink temperature > -25°C                                                                          |              | -40     |      |      |       |
| Cooling Water Inlet Temperature (Heatsink)      |                                                                                                       | θwater_inlet | -       |      | -    | °C    |
| Cooling Air Velocity (PCB and Capacitor)        |                                                                                                       | vAir_PCB     | 2       |      |      | m/s   |
| Air Pressure                                    | Standard atmosphere                                                                                   | pAir         | 900     |      | 1100 | hPa   |

|                          |                                                 |        |      |  |      |                  |
|--------------------------|-------------------------------------------------|--------|------|--|------|------------------|
| Humidity                 | No Condensation                                 | Rel. F | 0    |  | 95   | %                |
| Installation Height      |                                                 |        | 0    |  | 1000 | m                |
| Vibration                | EN60068-2-6, Fc<br>10..59Hz 0,075mm             |        |      |  | 10   | m/s <sup>2</sup> |
| Permanence Vibration     | EN60068-2-6, Fc<br>10-150Hz, 20 Cycles          |        |      |  | 20   | m/s <sup>2</sup> |
| Shock                    | EN60068-2-27, Ea<br>Half sine 11ms, 3<br>pulses |        |      |  | 100  | m/s <sup>2</sup> |
| Protection Degree        |                                                 |        | IP00 |  |      |                  |
| Pollution Degree         |                                                 |        | 2    |  |      |                  |
| Over Voltage<br>Category |                                                 |        | III  |  |      |                  |

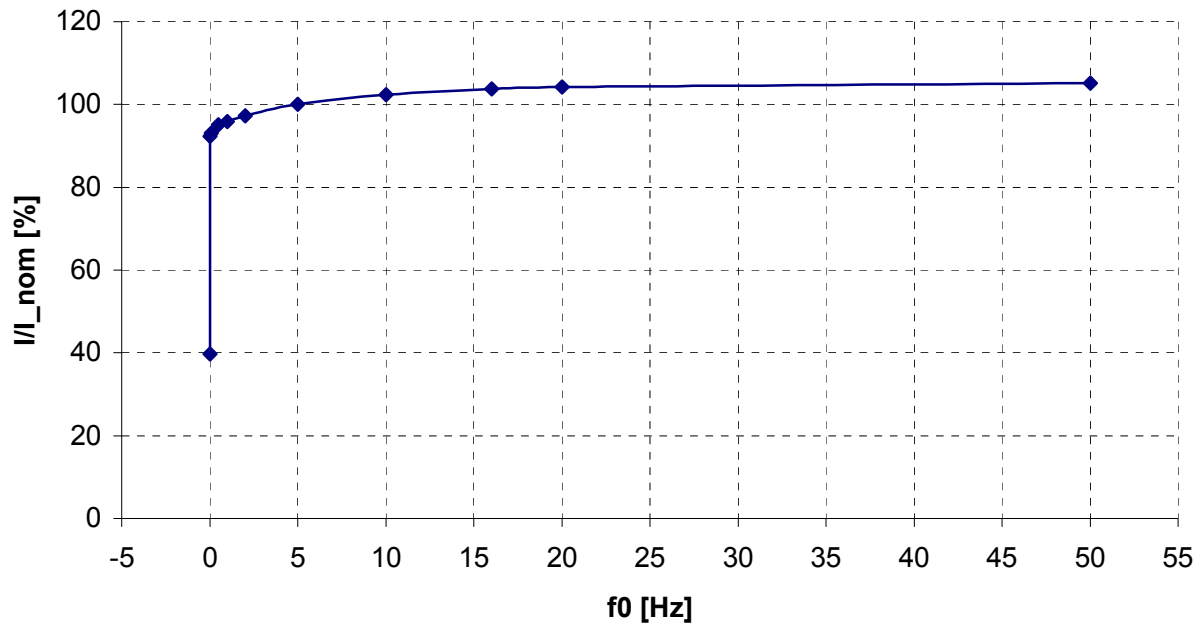
## Derating Curves (IGBT Part)

Current derating at low rotating field frequency ( $f_0$ ). Maximal 100% current is allowed.

$\cos(\phi) = 0.64$ , (motor)  
 $\Theta_{air} = 40^\circ\text{C}$

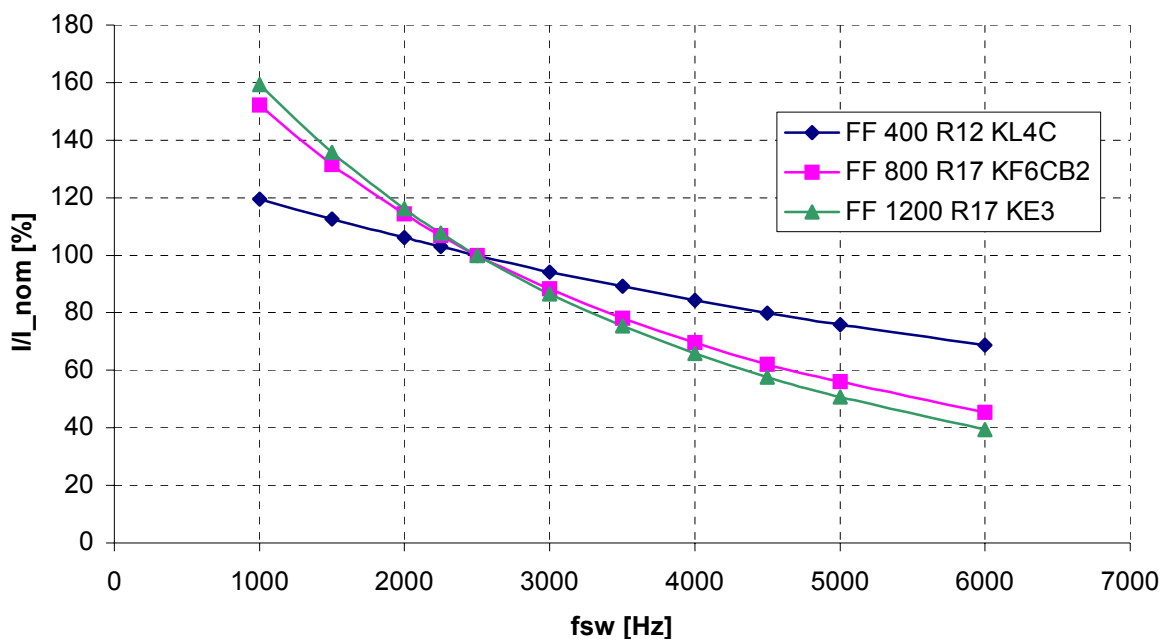


$\cos(\phi) = -0.64$ , (generator)  
 $\Theta_{\text{air}} = 40^{\circ}\text{C}$

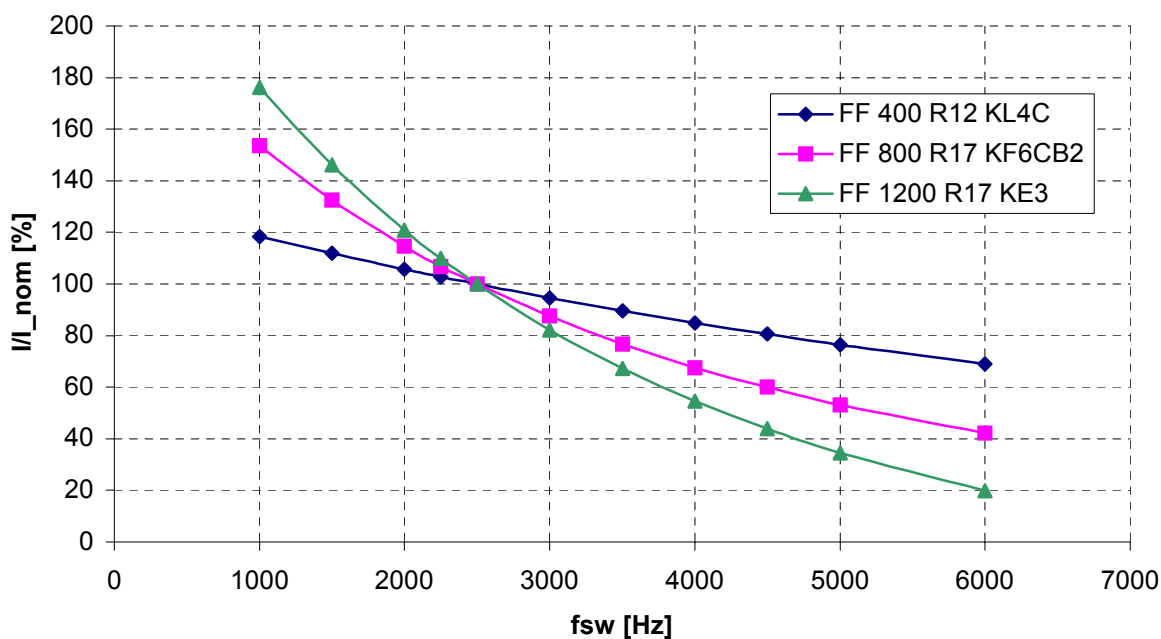


Current derating at different switching frequencies. See datatable for nominal switching frequency. In this drawing 2500Hz is assumed. **Maximal 100% current is allowed.**

IGBT,  $\cos(\phi) = 0.64$   
 $\Theta_{air} = 40^{\circ}\text{C}$

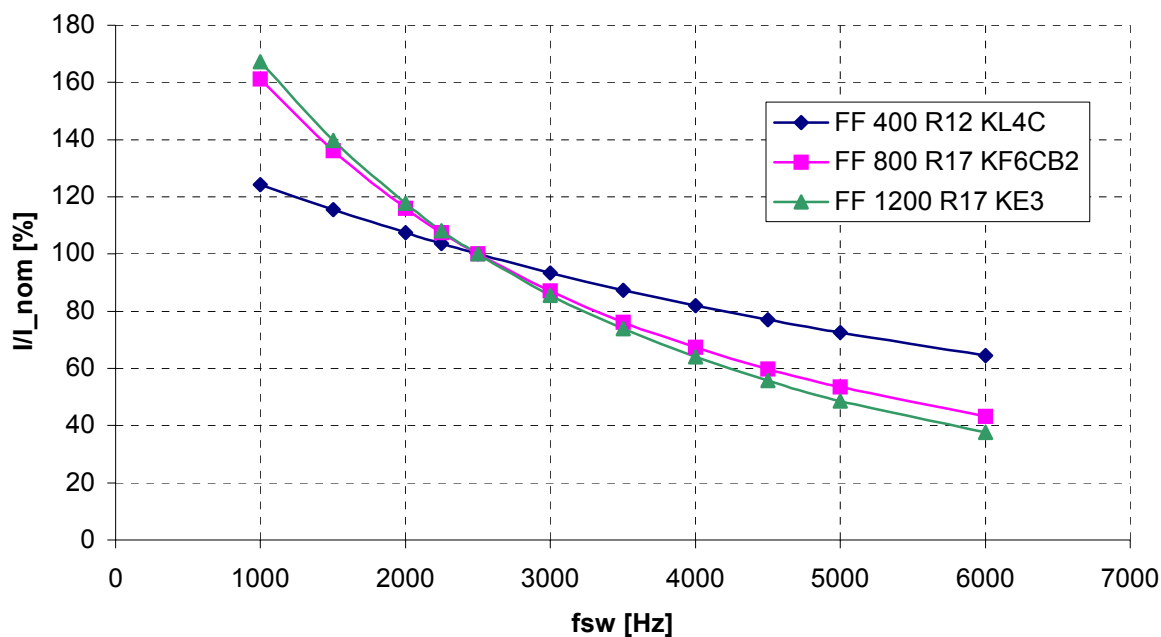


Diode,  $\cos(\phi) = 0.64$   
 $\Theta_{air} = 40^{\circ}\text{C}$



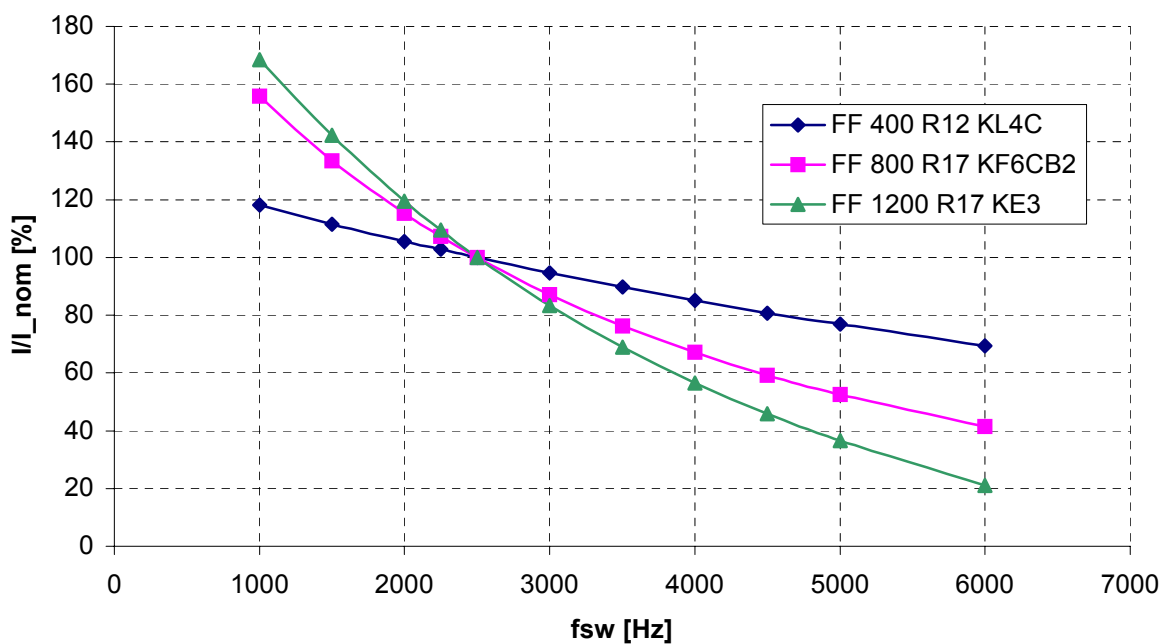
IGBT,  $\cos(\phi) = -0.64$

Theta<sub>air</sub> = 40°C



Diode,  $\cos(\phi) = -0.64$

Theta<sub>air</sub> = 40°C



## **Miscellaneous**

This technical information specifies semiconductor stacks but promises no characteristics. It is valid in combination with the belonging technical notes.

This document may be changed without prior notice.

## **Warning!**

Prior to installation and commissioning 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 missing or damaged signs are replaced.

The safety instructions have to be strictly adhered to.

The manual contains detailed information on all technical topics with regard to the eupec ModSTACK. For further details regarding publications of the eupec ModSTACK and information on other publications in the area of ModSTACKs please contact your nearest eupec branch or visit our website: <http://www.eupec.com>.

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|             |           |            |                     |               |
|-------------|-----------|------------|---------------------|---------------|
| Prepared by | J.Schiele | 2003-04-03 | Date of publication |               |
| Approved by | H.Nübel   | 2005-04-13 | Revision            | 2, 13.04.2005 |

2B6I\_/\_-\_-F/G/W

ModSTACK Size 3

38000032\_MB

