## flow3xNPC 1 — NPC Application — 650 V / 30 A

**General conditions**

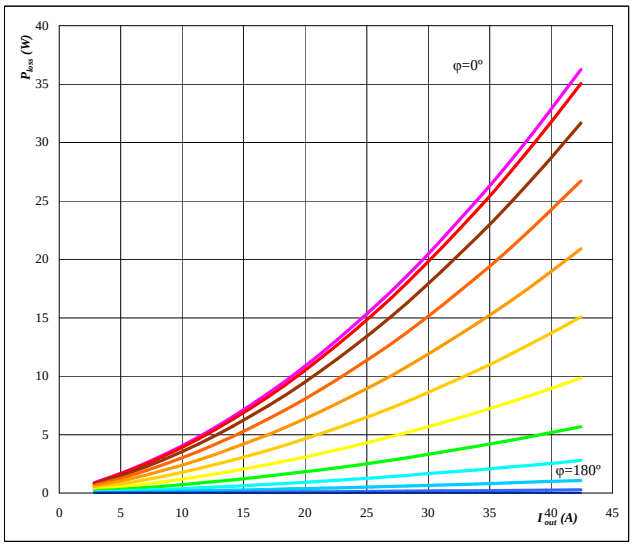
| BUCK | | |
|---|---|---|
| $V_{GEon}$ | = | 15 V |
| $V_{GEoff}$ | = | -15 V |
| $R_{gon}$ | = | 16 Ω |
| $R_{goff}$ | = | 16 Ω |

$V_{out}$ = 230 VAC

| BOOST | | |
|---|---|---|
| $V_{GEon}$ | = | 15 V |
| $V_{GEoff}$ | = | -15 V |
| $R_{gon}$ | = | 16 Ω |
| $R_{goff}$ | = | 16 Ω |

**Figure 1.** Buck IGBT

**Typical average static loss as a function of**

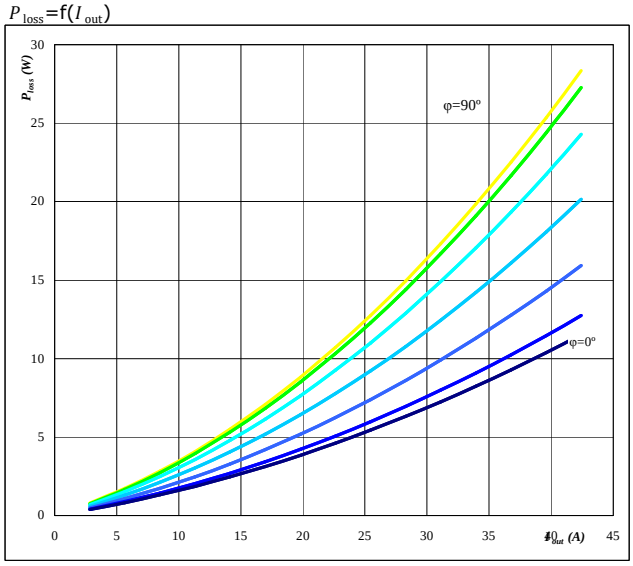



Conditions $T_j$ = 150 °C
parameter $\varphi$ from 0° to 180°
in 12 steps

**Figure 2.** Buck FWD

**Typical average static loss as a function of output current $I_{oRMS}$**

$P_{loss}$=f($I_{out}$)

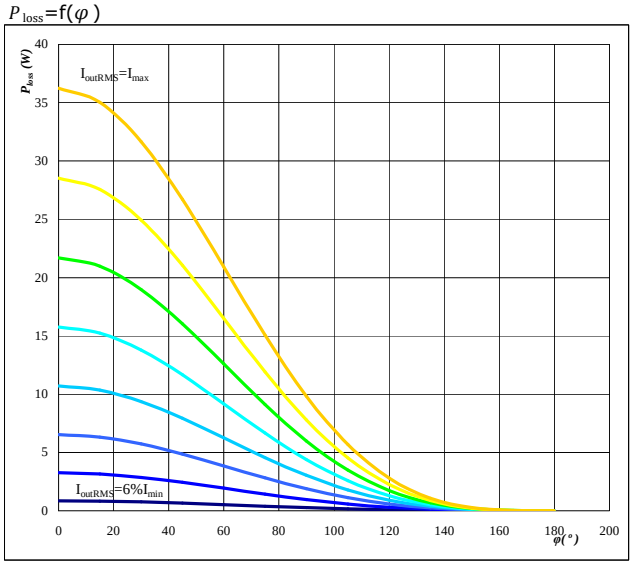



Conditions $T_j$ = 150 °C
parameter $\varphi$ from 0° to 180°
in 12 steps

**Figure 3.** Buck IGBT

**Typical average static loss as a function of phase displacement φ**

$P_{loss}$=f($\varphi$)

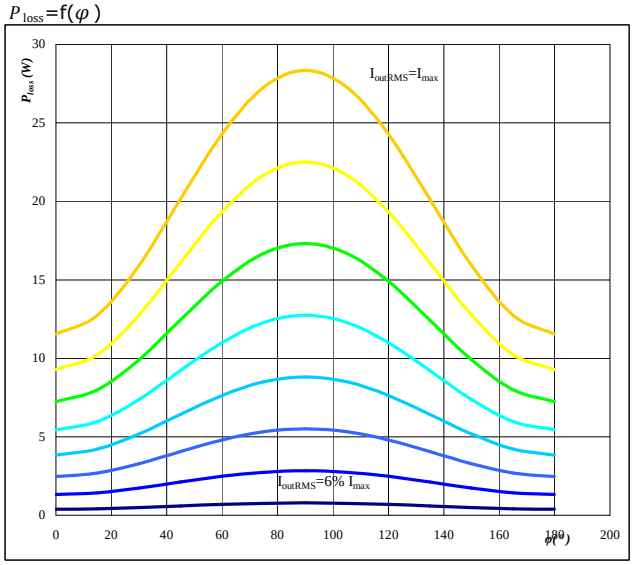



Conditions $T_j$ = 150 °C
parameter $I_{oRMS}$ from 2,83 A to 42 A
in steps of 6 A

**Figure 4.** Buck FWD

**Typical average static loss as a function of phase displacement φ**

$P_{loss}$=f($\varphi$)

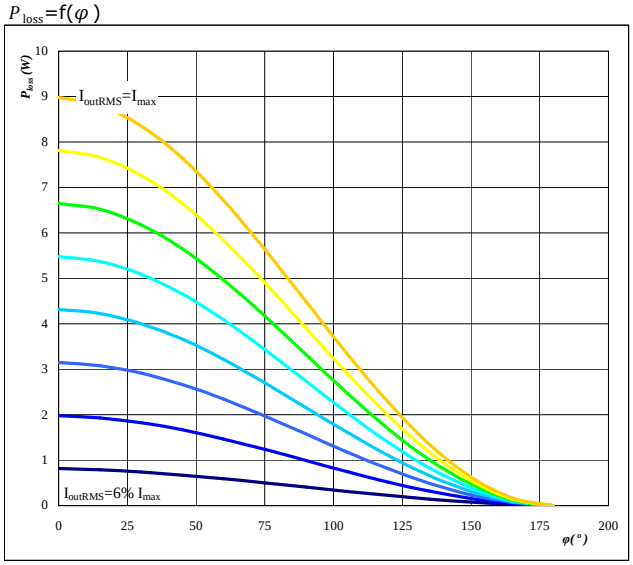



Conditions $T_j$ = 150 °C
parameter $I_{oRMS}$ from 2,83 A to 42 A
in steps of 6 A

**Figure 5.** **Buck IGBT**

**Typical average switching loss as a function of phase displacement φ**

$P_{loss}=f(\varphi)$

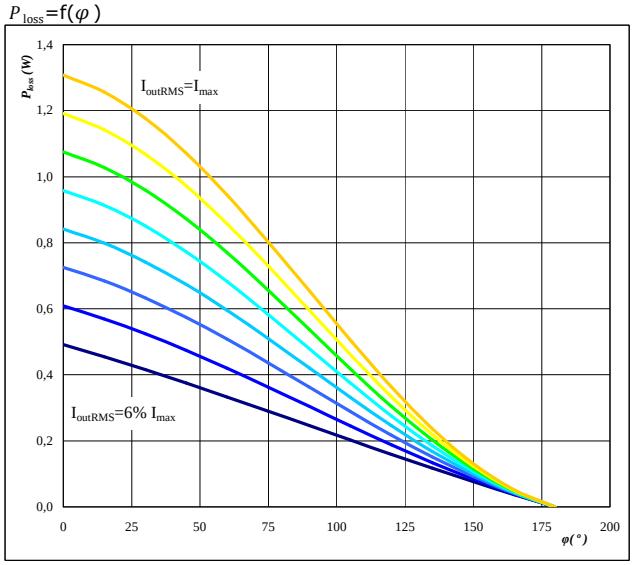



| | | | | |
|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | |
| | $f_{sw}$= | 20 | kHz | |
| | DC link= | 700 | V | |
| parameter | $I_{oRMS}$ | from 2,83 A | to | 42 A |
| | in steps of | 6 | A | |

**Figure 6.** **Buck FWD**

**Typical average switching loss as a function of phase displacement φ**

$P_{loss}=f(\varphi)$

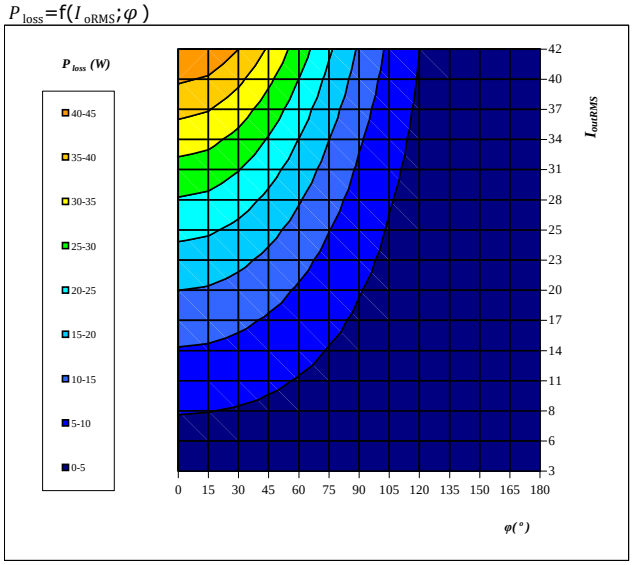



| | | | | |
|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | |
| | $f_{sw}$= | 20 | kHz | |
| | DC link= | 700 | V | |
| parameter | $I_{oRMS}$ | from 2,83 A | to | 42 A |
| | in steps of | 6 | A | |

**Figure 7.** **Buck IGBT**

**Typical total loss as a function of phase displacement φ and output current $I_{oRMS}$**

$P_{loss}=f(I_{oRMS};\varphi)$

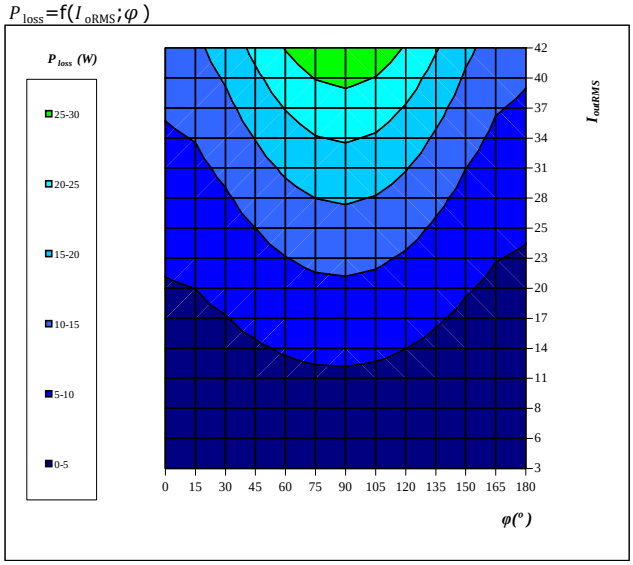



| | | | |
|---|---|---|---|
| Conditions | $T_j$= | 150 | °C |
| | DC link= | 700 | V |
| | $f_{sw}$= | 20 | kHz |

**Figure 8.** **Buck FWD**

**Typical total loss as a function of phase displacement φ and output current $I_{oRMS}$**

$P_{loss}=f(I_{oRMS};\varphi)$

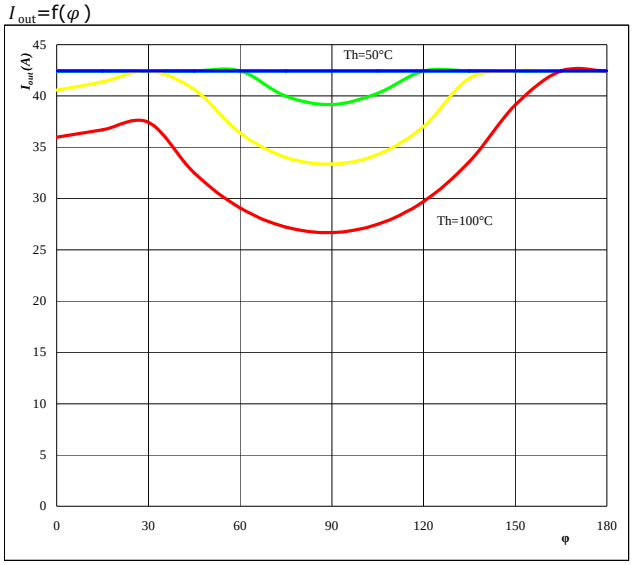



| | | | |
|---|---|---|---|
| Conditions | $T_j$= | 150 | °C |
| | DC link= | 700 | V |
| | $f_{sw}$= | 20 | kHz |

**Figure 9.** **for Buck IGBT+FWD**

**Typical available output current as a function of phase displacement φ**

$I_{out}=f(\varphi)$

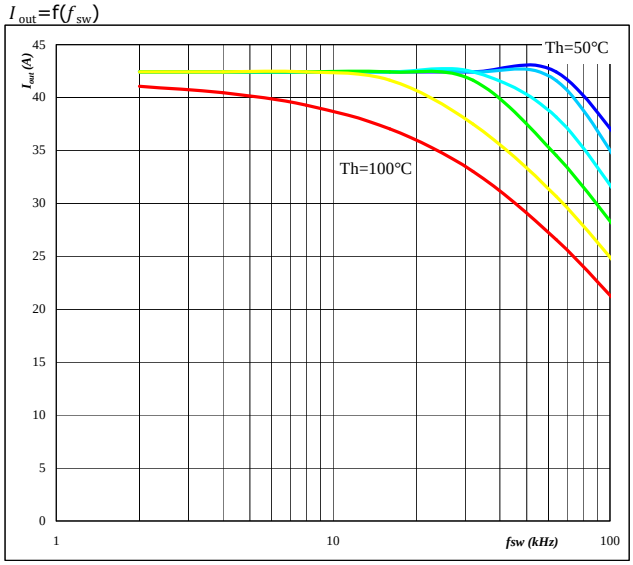



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | $f_{sw}$= | 20 kHz |
| | DC link= | 700 | V | | |
| parameter: | Heatsink temp. | | | | |
| | $T_h$ from | 50 | °C to | 100 | °C |
| | in | 10 | °C | steps | |

**Figure 10.** **for Buck IGBT+FWD**

**Typical available output current as a function of switching frequency $f_{sw}$**

$I_{out}=f(f_{sw})$

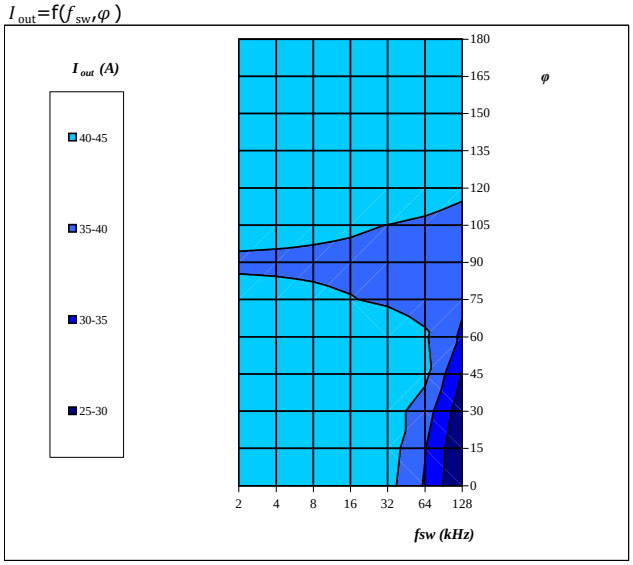



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | $\varphi$ = | 0 ° |
| | DC link= | 700 | V | | |
| parameter | Heatsink temp. | | | | |
| | $T_h$ from | 50 | °C to | 100 | °C |
| | in | 10 | °C | steps | |

**Figure 11.** **for Buck IGBT+FWD**

**Typical available 50Hz output current as a function of fsw and phase displacement φ**

$I_{out}=f(f_{sw},\varphi)$

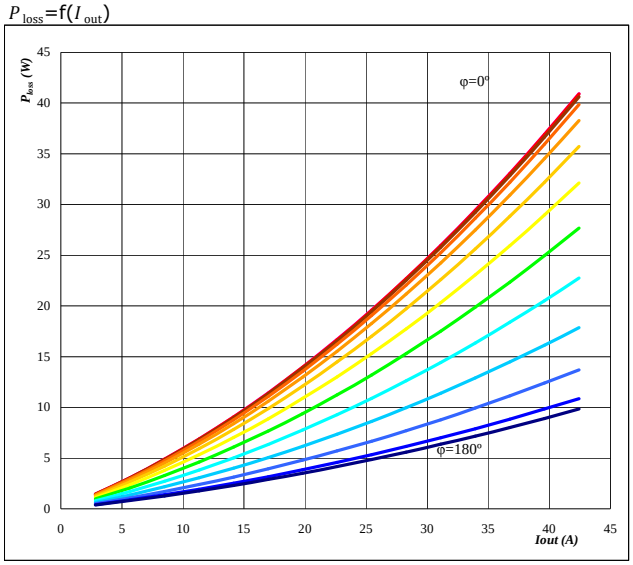



| | | | |
|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C |
| | DC link= | 700 | V |
| | $T_h$= | 80 | °C |

**Figure 12.** **Boost IGBT**

**Typical average static loss as a function of output current**

$P_{loss}=f(I_{out})$

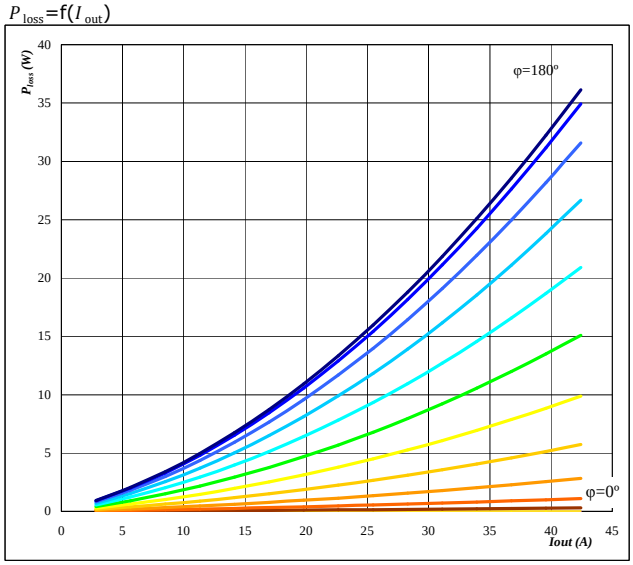



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | | |
| parameter | $\varphi$ | from | 0° | to | 180° |
| | | in | 12 | steps | |

**Figure 13.** **Boost FWD**

**Typical average static loss as a function of output current**

$P_{loss}=f(I_{out})$

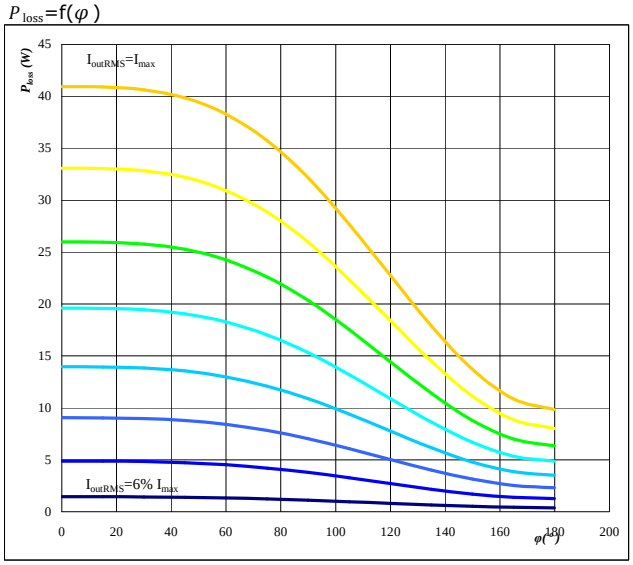



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | | |
| parameter | $\varphi$ | from | 0° | to | 180° |
| | | in | 12 | steps | |

**Figure 14.** **Boost IGBT**

**Typical average static loss as a function of phase displacement**

$P_{loss}=f(\varphi)$

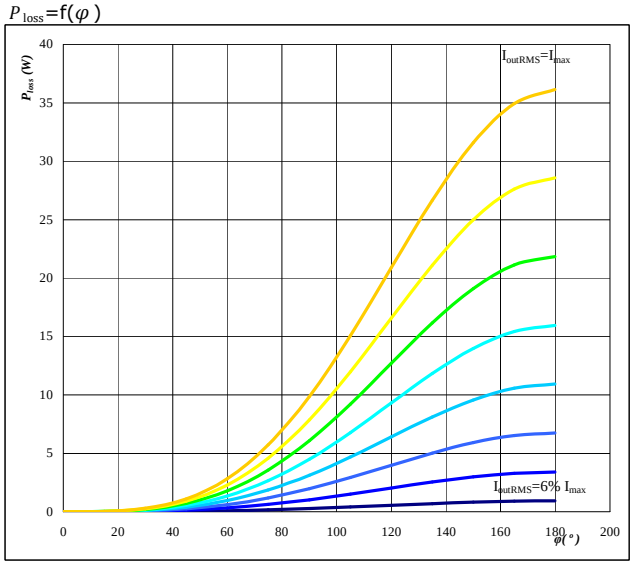



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | | |
| parameter | $I_{oRMS}$ | from | 3 A | to | 42 A |
| | | in steps of | 6 A | | |

**Figure 15.** **Boost FWD**

**Typical average static loss as a function of phase displacement**

$P_{loss}=f(\varphi)$

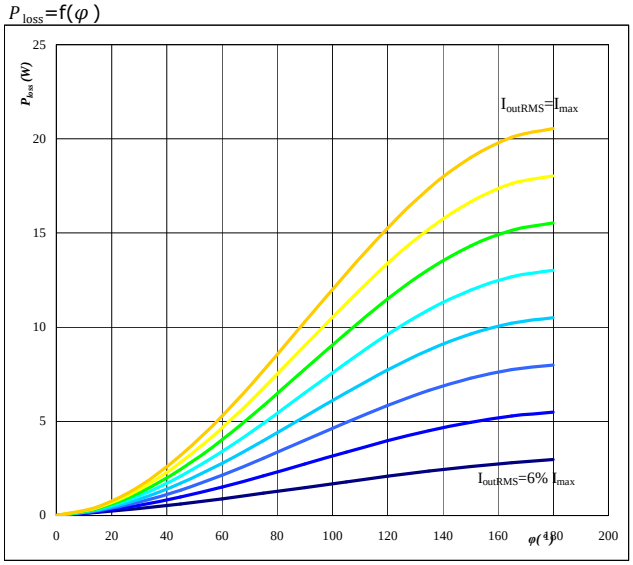



| | | | | | |
|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | | |
| parameter | $I_{oRMS}$ | from | 3 A | to | 42 A |
| | | in steps of | 6 A | | |

**Figure 16.** **Boost IGBT**

**Typical average switching loss as a function of phase displacement**

$P_{loss}=f(\varphi)$

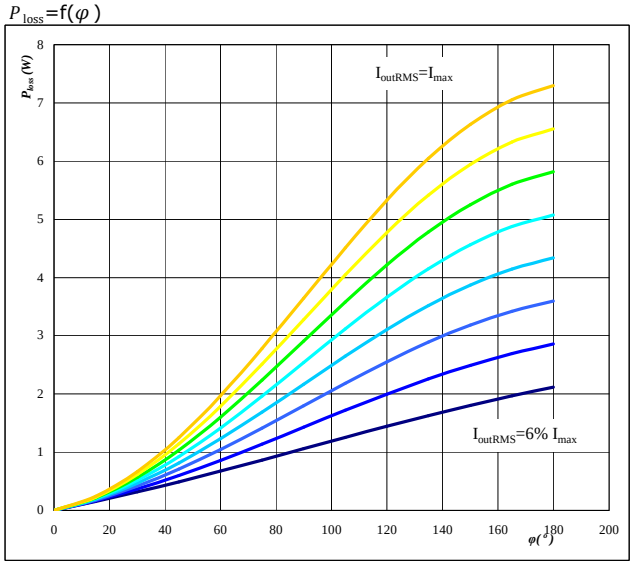



| | | | | | | |
|---|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | $f_{sw}$= | 20 | kHz |
| | DC link= | 700 | V | | | |
| parameter | $I_{oRMS}$ | from | 3 A | to | 42 A | |
| | | in steps of | 6 A | | A | |

**Figure 17.** **Boost FWD**

**Typical average switching loss as a function of phase displacement**

$P_{loss}=f(\varphi)$

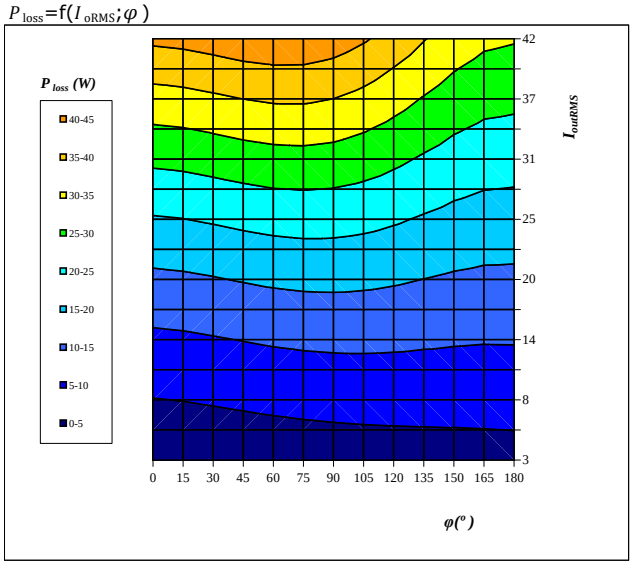



| | | | | | | |
|---|---|---|---|---|---|---|
| Conditions | $T_j$= | 150 | °C | $f_{sw}$= | 20 | kHz |
| | DC link= | 700 | V | | | |
| parameter | $I_{oRMS}$ | from | 3 A | to | 42 A | |
| | | in steps of | 6 A | | A | |

**Figure 18.** **Boost IGBT**

**Typical total loss as a function of phase displacement and Iout$_{RMS}$**

$P_{loss}=f(I_{oRMS};\varphi)$

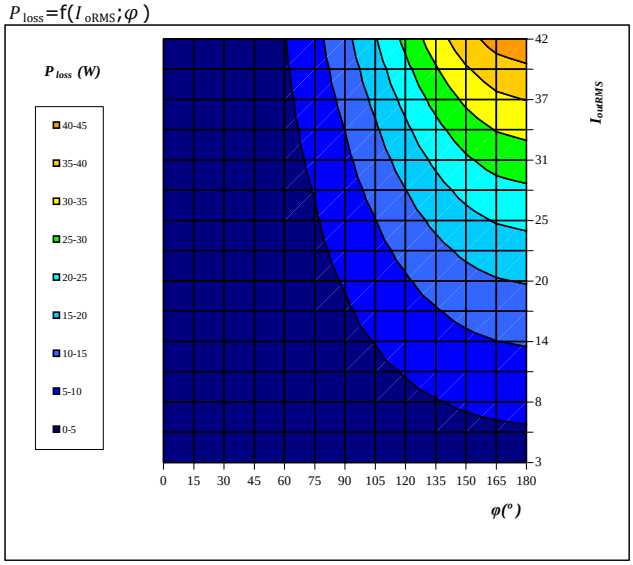



| | | | |
|---|---|---|---|
| Conditions | $T_j$= | 150 | °C |
| | DC link= | 700 | V |
| | $f_{sw}$= | 20 | kHz |

**Figure 19.** **Boost FWD**

**Typical total loss as a function of phase displacement and Iout$_{RMS}$**

$P_{loss}=f(I_{oRMS};\varphi)$



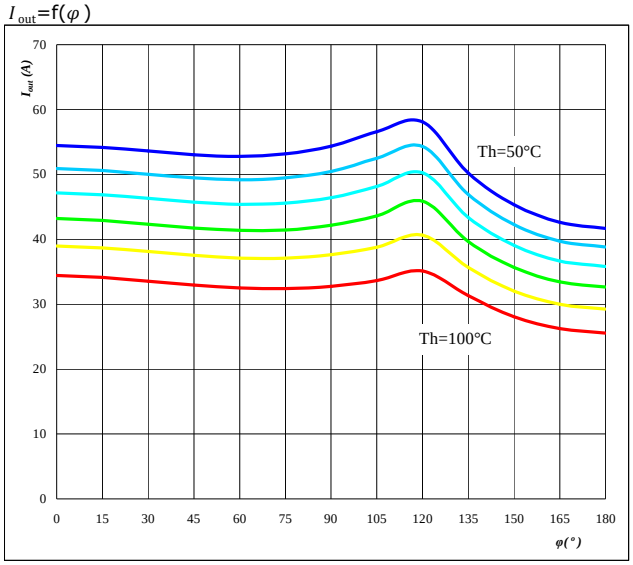

| | | | |
|---|---|---|---|
| Conditions | $T_j$= | 150 | °C |
| | DC link= | 700 | V |
| | $f_{sw}$= | 20 | kHz |

## flow3xNPC 1 — NPC Application — 650 V / 30 A

**Figure 20.** **Boost IGBT+FWD**

**Typical available output current as a function of of phase displacement**

$I_{out}=f(\varphi)$

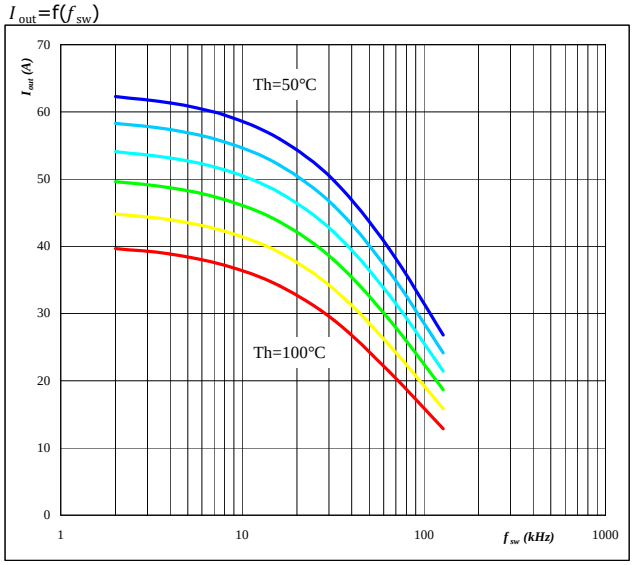



| | | | | | | |
|---|---|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | $f_{sw}$= | 20 | kHz |
| | DC link= | 700 | V | | | |
| parameter: | Heatsink temp. | | | | | |
| | $T_h$ from | 50 | °C to | 100 | °C | |
| | in | 10 | °C | steps | | |

**Figure 21.** **Boost IGBT+FWD**

**Typical available output current as a function of switching frequency**

$I_{out}=f(f_{sw})$

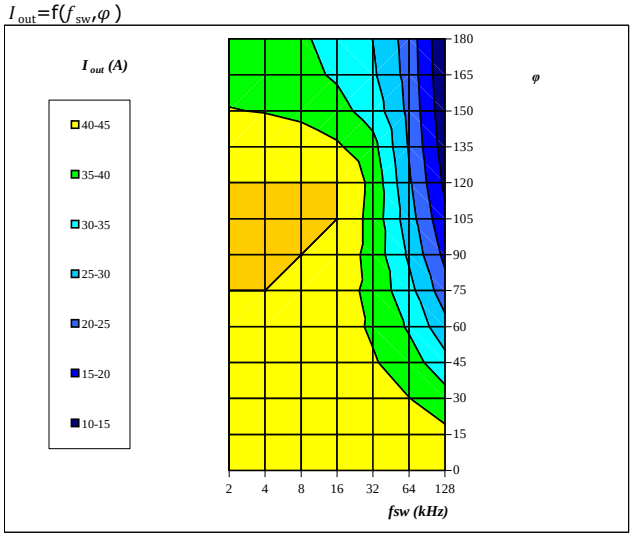



| | | | | | | |
|---|---|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | $\varphi$ = | 90° | |
| | DC link= | 700 | V | | | |
| parameter: | Heatsink temp. | | | | | |
| | $T_h$ from | 50 | °C to | 100 | °C | |
| | in | 10 | °C | steps | | |

**Figure 22.** **Boost IGBT+FWD**

**Typical available 50Hz output current as a function of** $f_{sw}$ and phase displacement

$I_{out}=f(f_{sw},\varphi)$

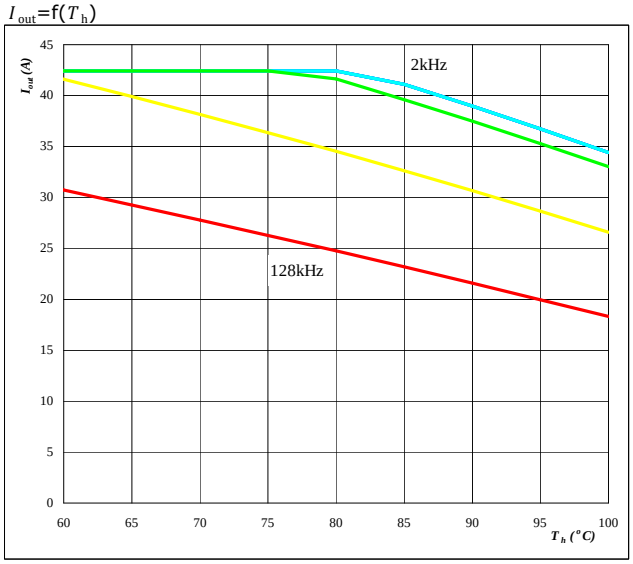



| | | | |
|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C |
| | DC link= | 700 | V |
| | $T_h$= | 80 | °C |

**Figure 23.** **per MODULE**

**Typical available output current as a function of heat sink temperature**

$I_{out}=f(T_h)$

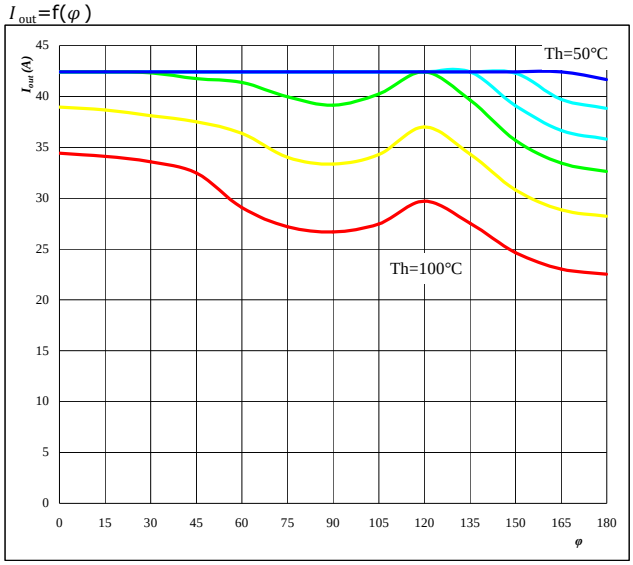



| | | | | |
|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | |
| | DC link= | 700 | V | |
| | $\varphi$ = | 0 ° | | |
| parameter: | Switching freq. | | | |
| | $f_{sw}$ from | 2 | kHz to | 128 kHz |
| | in steps of factor 2 | | | |

**Figure 24.** **per MODULE**

**Typical available output current as a function of phase displacement**

$I_{out}=f(\varphi)$

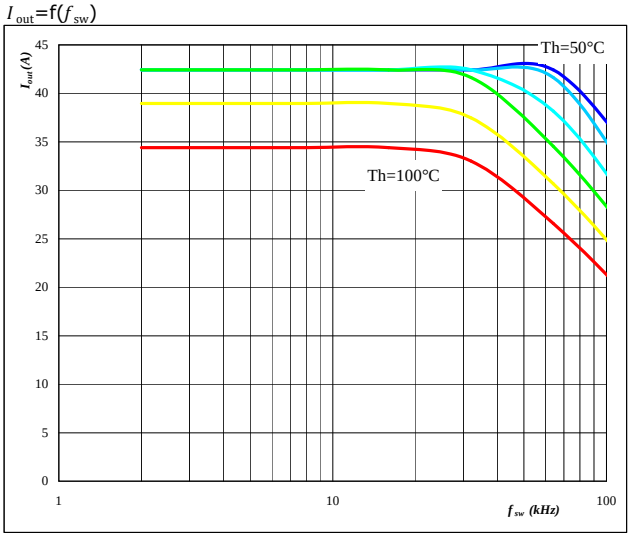



| | | | | |
|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | |
| | DC link= | 700 | V | |
| | $f_{sw}$= | 20 | kHz | |
| parameter: | Heatsink temp. | | | |
| | $T_h$ from | 50 | °C to | 100 |
| | in | 10 | °C | steps |

**Figure 25.** **per MODULE**

**Typical available output current as a function of switching frequency**

$I_{out}=f(f_{sw})$

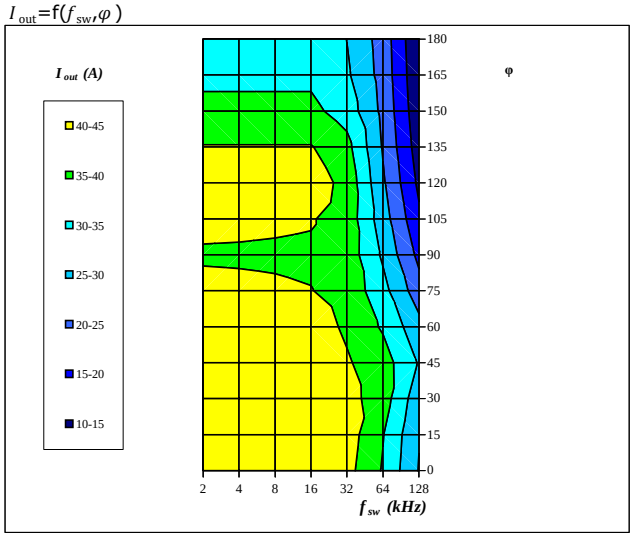



| | | | | | | |
|---|---|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | $\varphi$ = | 0 ° | |
| | DC link= | 700 | V | | | |
| parameter: | Heatsink temp. | | | | | |
| | $T_h$ from | 50 | °C to | 100 | | |
| | in | 10 | °C | steps | | |

**Figure 26.** **per MODULE**

**Typical available 50Hz output current as a function of** $f_{sw}$ and phase displacement

$I_{out}=f(f_{sw},\varphi)$

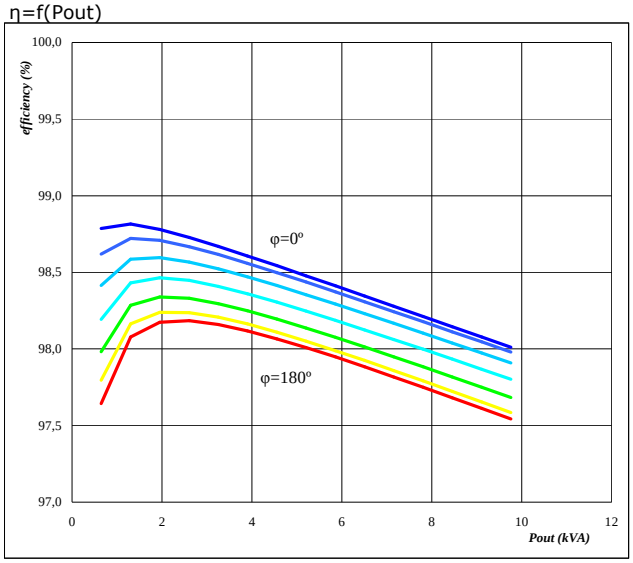



| | | | | |
|---|---|---|---|---|
| Conditions | $T_j$= | $T_{jmax}$-25 | °C | |
| | DC link= | 700 | V | |
| | $T_h$= | 80 | °C | |

**Figure 27.** **per MODULE**

**Typical efficiency as a function of output power**

η=f(Pout)

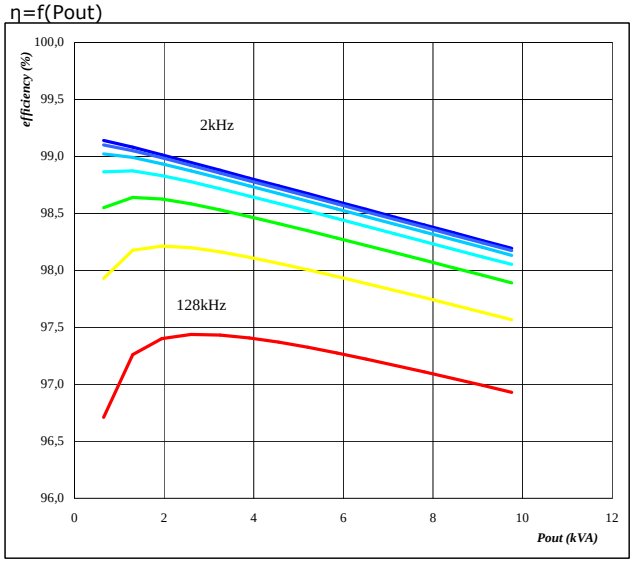



Conditions $T_j$= 125 °C
$f_{sw}$= 20 kHz
DC link= 700 V
parameter: phase displacement
$\varphi$ from 0 ° to 180 °
in steps of 30 °

**Figure 28.** **per MODULE**

**Typical efficiency as a function of output power**

η=f(Pout)

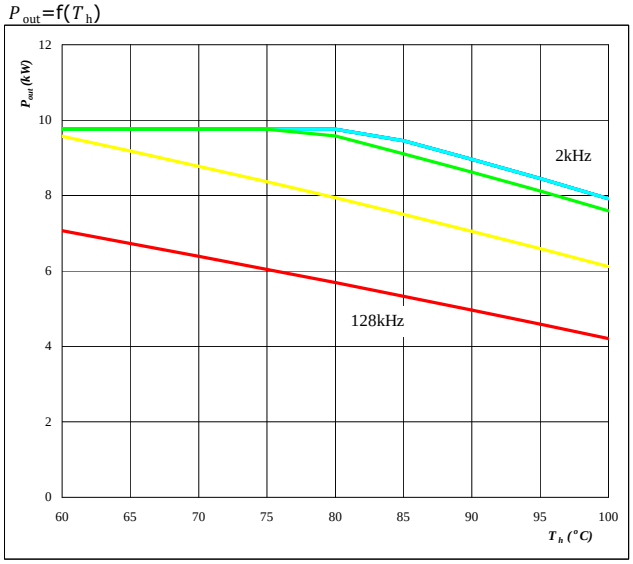



Conditions $T_j$= 125 °C $\varphi$ = 0 °
DC link= 700 V
parameter: Switching freq.
$f_{sw}$ from 2 kHz to 128 kHz
in steps of factor 2

**Figure 29.** **per MODULE**

**Typical available output power as a function of heat sink temperature**

$P_{out}$=f($T_h$)




Conditions $T_j$= $T_{jmax}$-25 °C
DC link= 700 V
$\varphi$ = 0 °
parameter: Switching freq.
$f_{sw}$ from 2 kHz to 128 kHz
in steps of factor 2

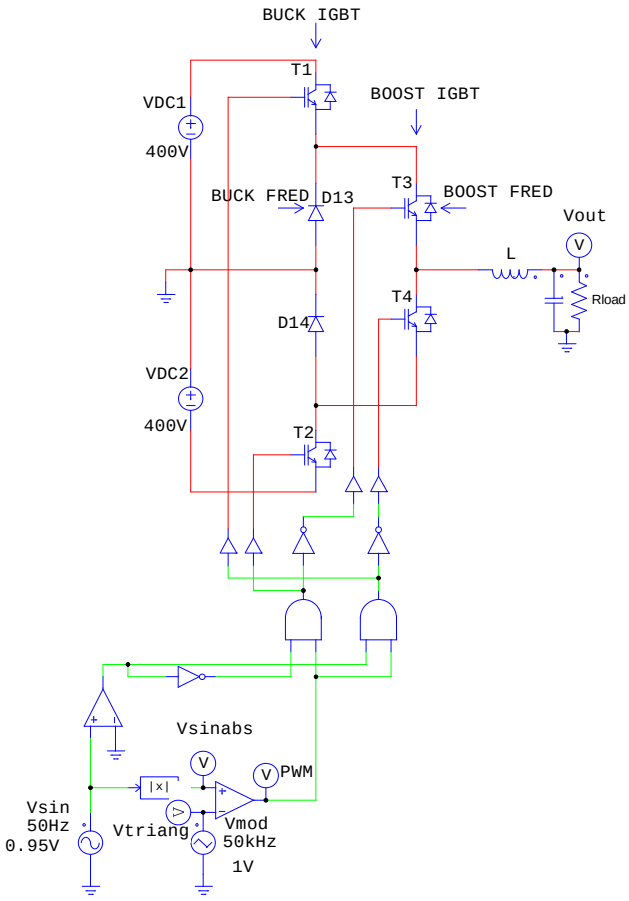
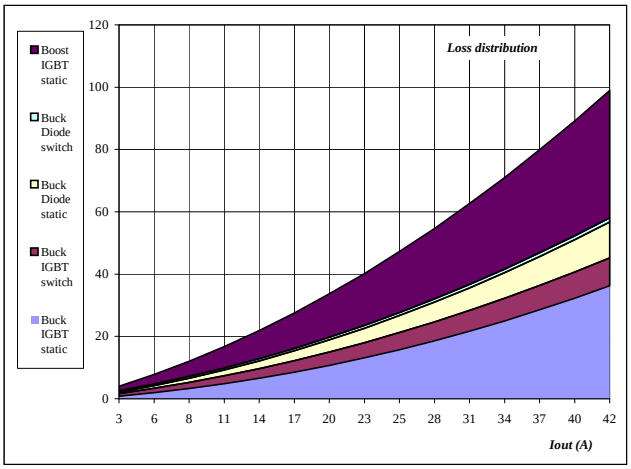


**Figure 30.** **per MODULE**

**Typical loss distribution as a function of output current**

$P_{out}$=f($T_h$)

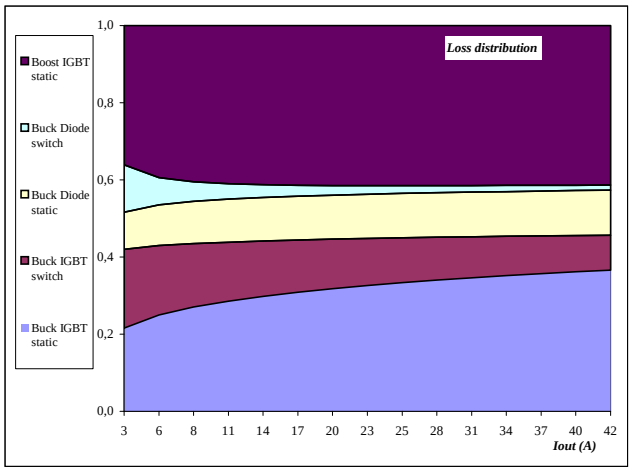



| Conditions | | | |
|---|---|---|---|
| | $T_j$= | 125 | °C |
| | $f_{sw}$= | 20 | kHz |
| | DC link= | 700 | V |
| | $\varphi$ = | 0 ° | |

**Figure 31.** **per MODULE**

**Typical relativ loss distribution as a function of output current**

$P_{out}$=f($T_h$)




| Conditions | | | |
|---|---|---|---|
| | $T_j$= | 125 | °C |
| | $f_{sw}$= | 20 | kHz |
| | DC link= | 700 | V |
| | $\varphi$ = | 0 ° | |