flowNPC1	NPC Application	600V/150A

General conditions

BUCK		
V_{GEon}	=	15 V
V_{GEoff}	=	-15 V
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Vout= 230 VAC

BOOST		
V_{GEon}	=	15 V
V_{GEoff}	=	-15 V
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1. **Buck MOSFET**

Typical average static loss as a function of
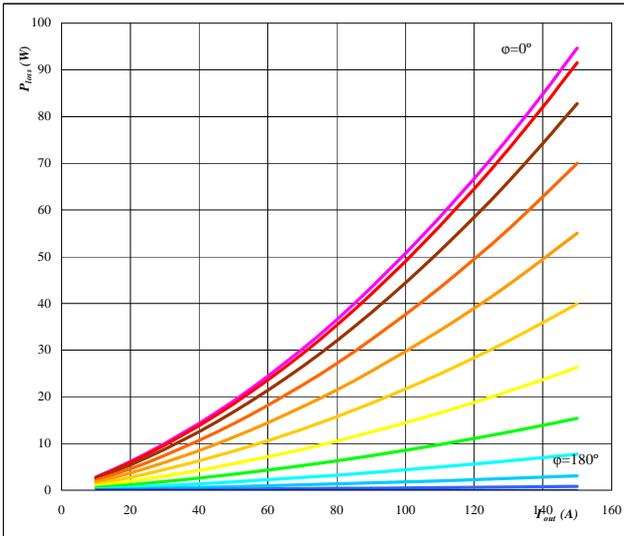
Conditions: T_j= 150 °C
parameter: **φ** from 0° to 180°
in 12 steps

Figure 2. **Buck FRED**

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

$P_{loss}=f(I_{out})$
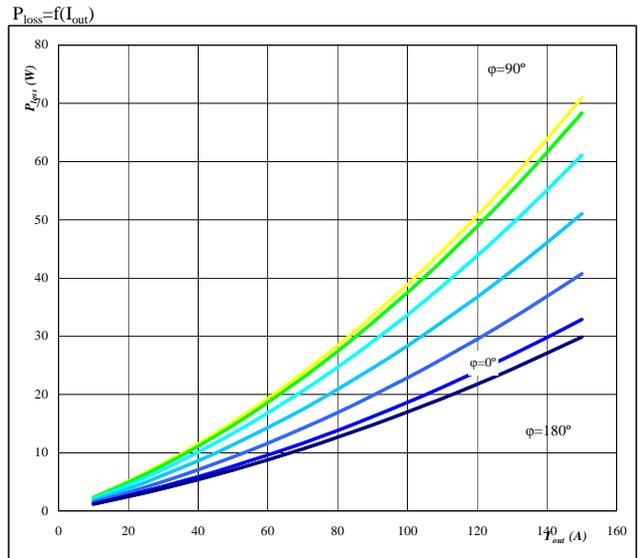
Conditions: T_j= 150 °C
parameter: **φ** from 0° to 180°
in 12 steps

Figure 3. **Buck MOSFET**

Typical average static loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$
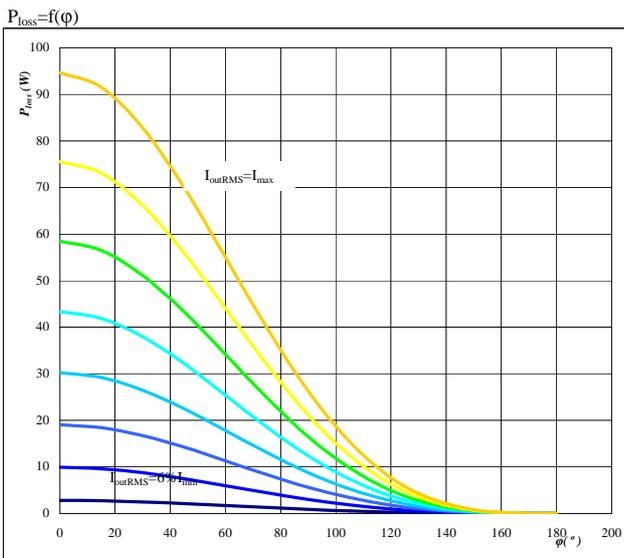
Conditions: T_j= 150 °C
parameter: I_{oRMS} from 10 A to 150 A
in steps of 20 A

Figure 4. **Buck FRED**

Typical average static loss as a function of phase displacement φ

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

Conditions: T_j= 150 °C
parameter: I_{oRMS} from 10 A to 150 A
in steps of 20 A
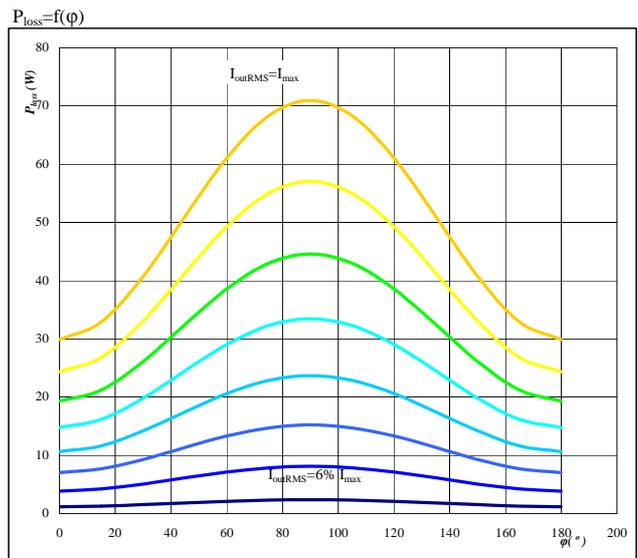
flowNPC1	NPC Application	600V/150A

Figure 5. **Buck MOSFET**

Typical average switching loss as a function of phase displacement φ
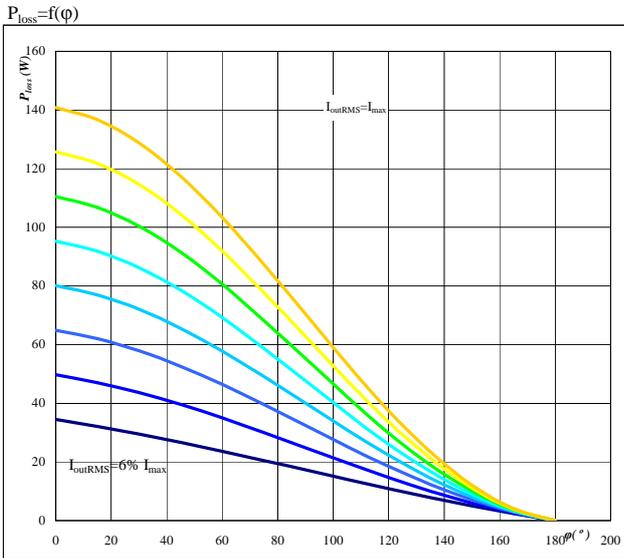
$P_{loss}=f(\varphi)$

Conditions:
	T_j=	150	°C		
	f_{sw}=	20	kHz		
	DC link=	700	V		
parameter:	I_{oRMS}	from	10 A	to	150 A
		in steps of	20	A	

Figure 6. **Buck FRED**

Typical average switching loss as a function of phase displacement φ
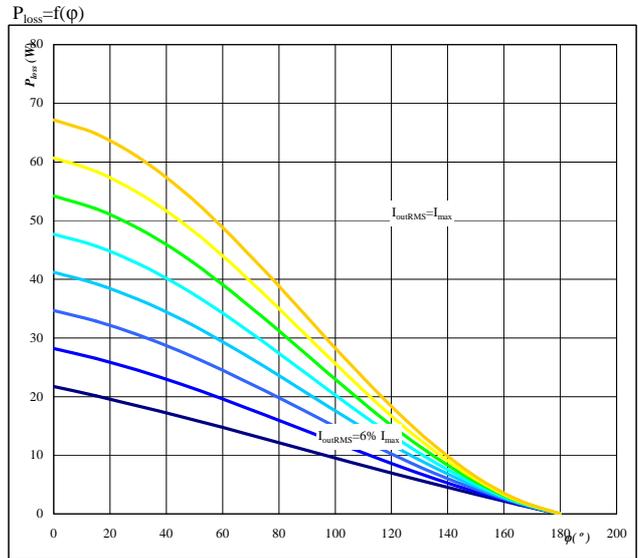
$P_{loss}=f(\varphi)$

Conditions:
	T_j=	150	°C		
	f_{sw}=	20	kHz		
	DC link=	700	V		
parameter:	I_{oRMS}	from	10 A	to	150 A
		in steps of	20	A	

Figure 7. **Buck MOSFET**

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

$P_{loss}=f(Io_{RMS};\varphi)$
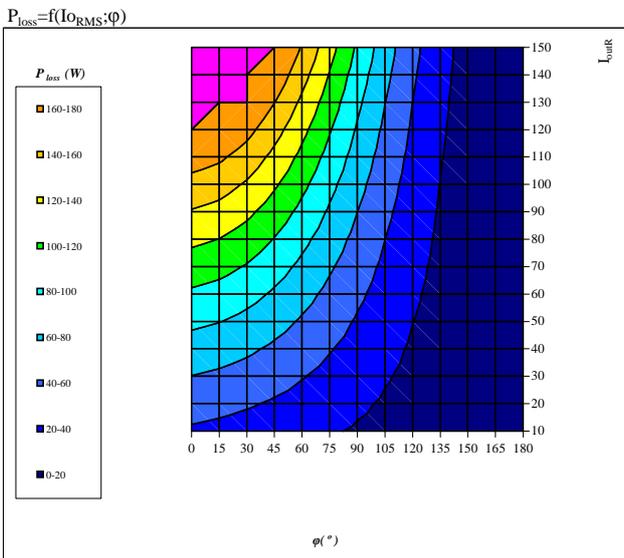
Conditions:
	T_j=	150	°C
	DC link=	700	V
	f_{sw}=	20	kHz

Figure 8. **Buck FRED**

Typical total loss as a function of phase displacement φ and output current I_{oRMS}
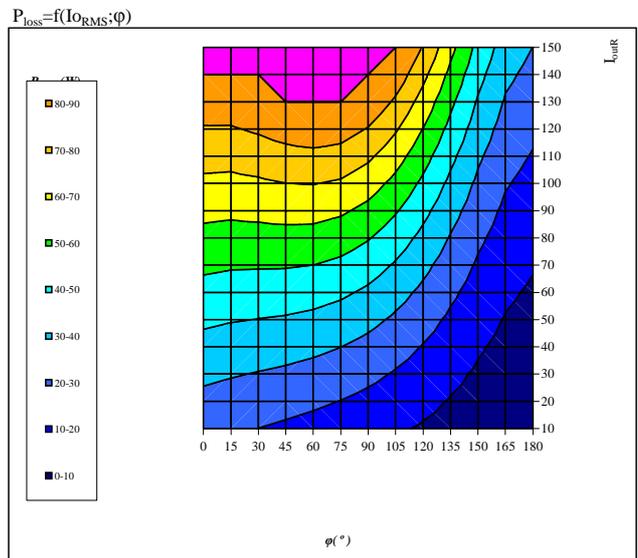
$P_{loss}=f(Io_{RMS};\varphi)$

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

flowNPC1 | **NPC Application** | **600V/150A**

for Buck MOSFET+FRED

Typical available output current as a function of phase displacement φ

$I_{out}=f(\varphi)$
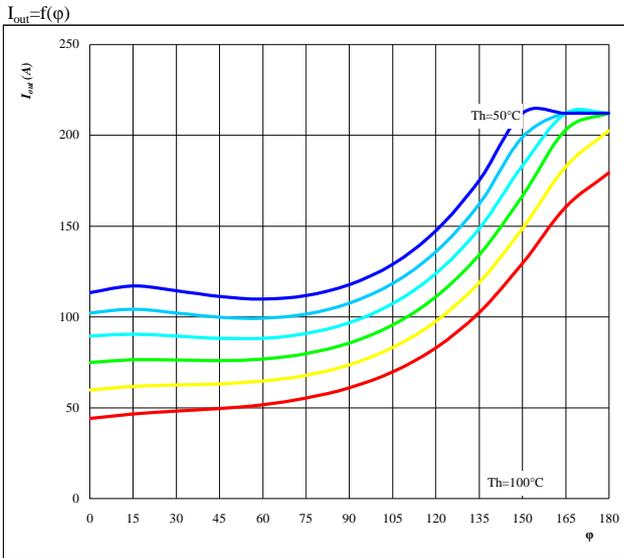
Figure 10. for Buck MOSFET+FRED

Typical available output current as a function of switching frequency f_{sw}
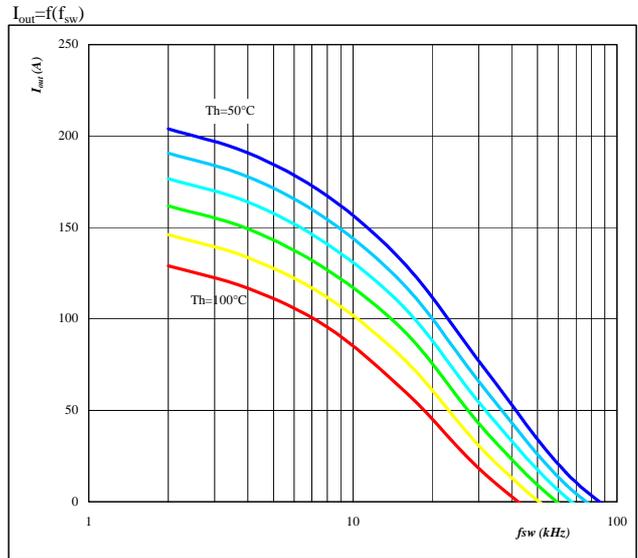
$I_{out}=f(f_{sw})$

Conditions: T_j= Tjmax-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

Conditions: T_j= Tjmax-25 °C φ= 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+FRED

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

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

Conditions: T_j= Tjmax-25 °C
DC link= 700 V
T_h= 80 °C

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flowNPC1 | **NPC Application** | **600V/150A**
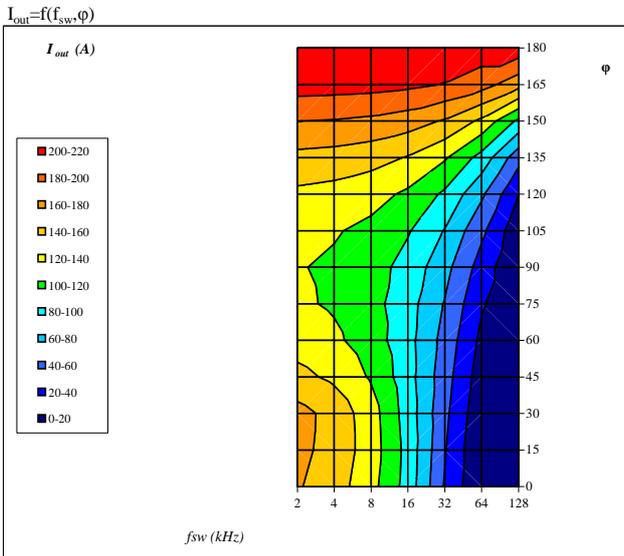
Figure 12. **Boost IGBT**

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

$P_{loss}=f(Iout)$
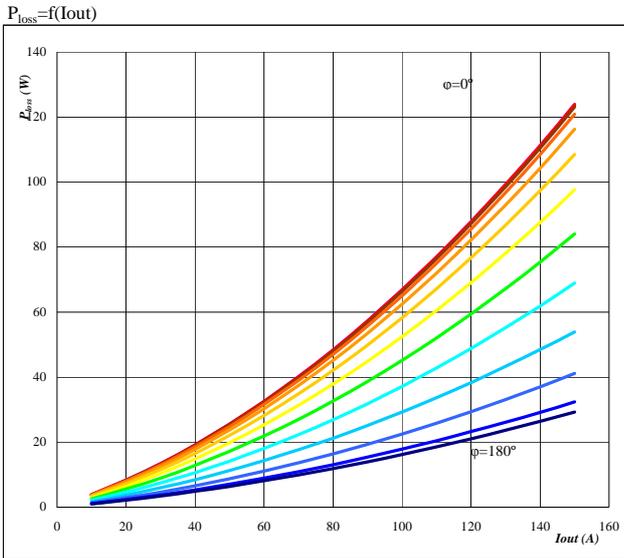
Conditions: $T_j=$ 150 °C

parameter: **φ** from 0° to 180°

in 12 steps

Figure 13. **Boost FRED**

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

$P_{loss}=f(Iout)$
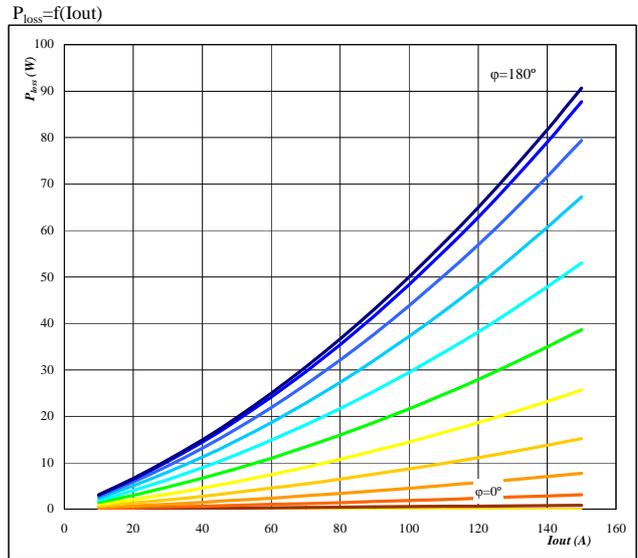
Conditions: $T_j=$ 150 °C

parameter: **φ** from 0° to 180°

in 12 steps


Figure 14. **Boost IGBT**

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

$P_{loss}=f(φ)$
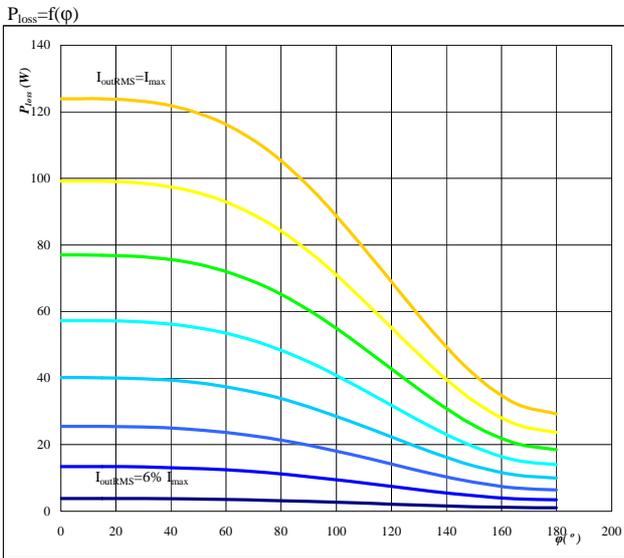
Conditions: $T_j=$ 150 °C

parameter: I_{oRMS} from 10 A to 150 A

in steps of 20 A


Figure 15. **Boost FRED**

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

$P_{loss}=f(φ)$

Conditions: $T_j=$ 150 °C

parameter: I_{oRMS} from 10 A to 150 A

in steps of 20 A


Revision: 5
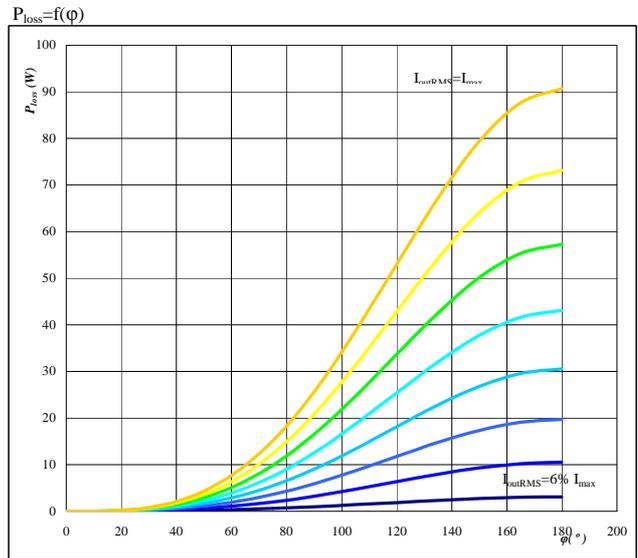
| flowNPC1 | NPC Application | 600V/150A |

| Figure 16. | Boost IGBT |

Typical average switching loss as a function of phase displacement
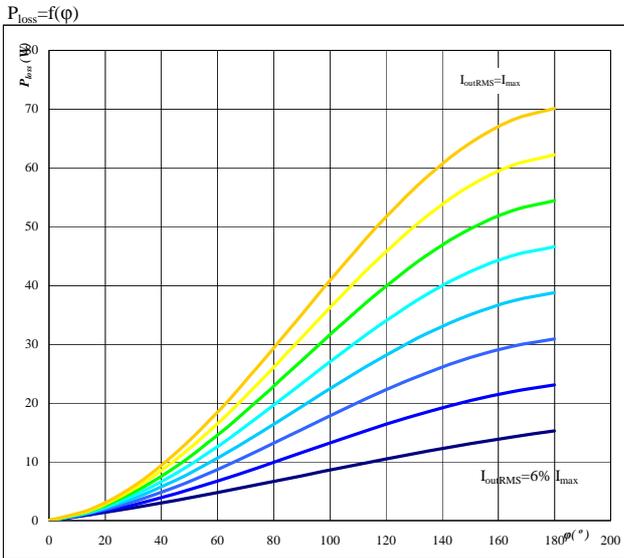
$P_{loss}=f(\varphi)$

Conditions:	$T_j=$	150	°C		$f_{sw}=$	20 kHz
	DC link=	700	V			
parameter:	I_{oRMS}	from	10	A	to	150 A
		in steps of	20	A	A	

| Figure 17. | Boost FRED |

Typical average switching loss as a function of phase displacement
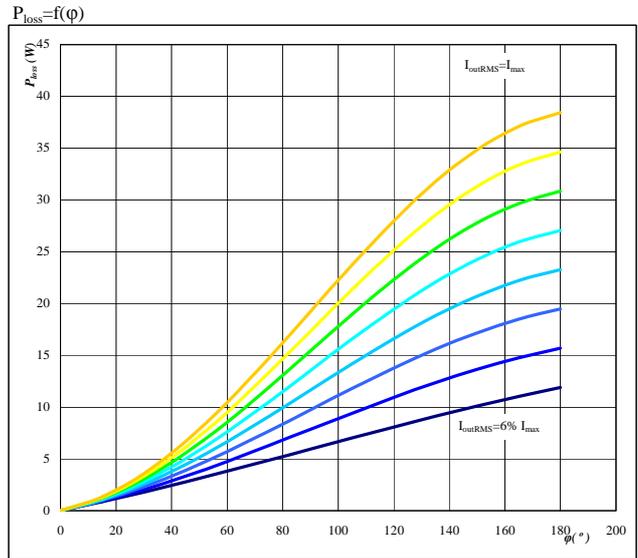
$P_{loss}=f(\varphi)$

Conditions:	$T_j=$	150	°C		$f_{sw}=$	20 kHz
	DC link=	700	V			
parameter:	I_{oRMS}	from	10	A	to	150 A
		in steps of	20	A	A	

| Figure 18. | Boost IGBT |

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

$P_{loss}=f(Io_{RMS};\varphi)$
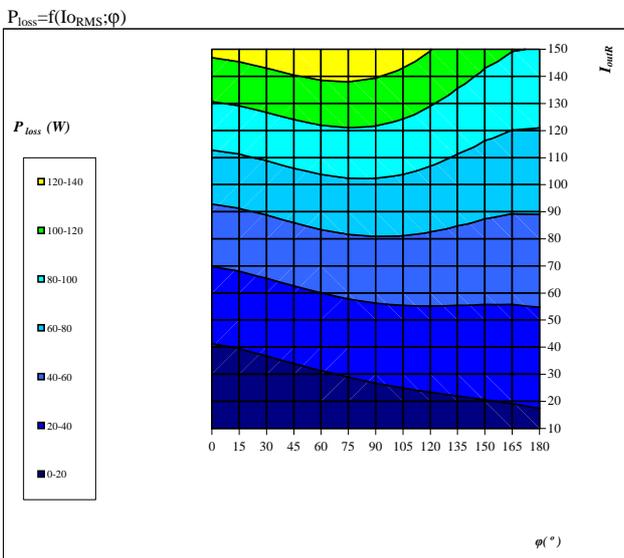
Conditions:	$T_j=$	150	°C
	DC link=	700	V
	$f_{sw}=$	20	kHz

| Figure 19. | Boost FRED |

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

$P_{loss}=f(Io_{RMS};\varphi)$

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

flowNPC1 | **NPC Application** | **600V/150A**
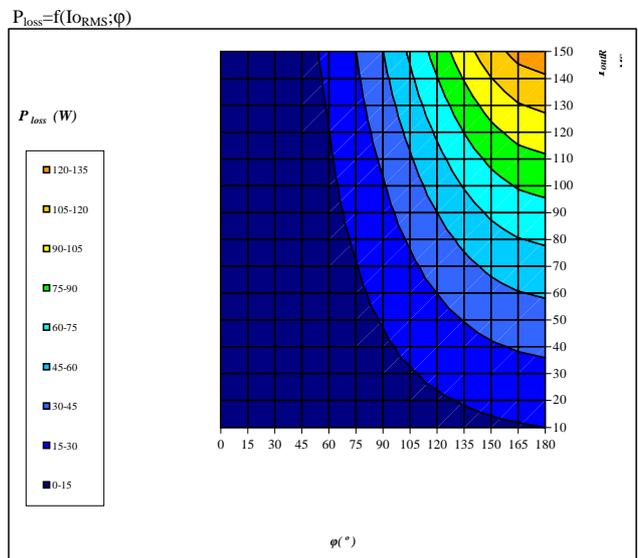
Figure 20. | Boost IGBT+FRED

Typical available output current as a function of of phase displacement
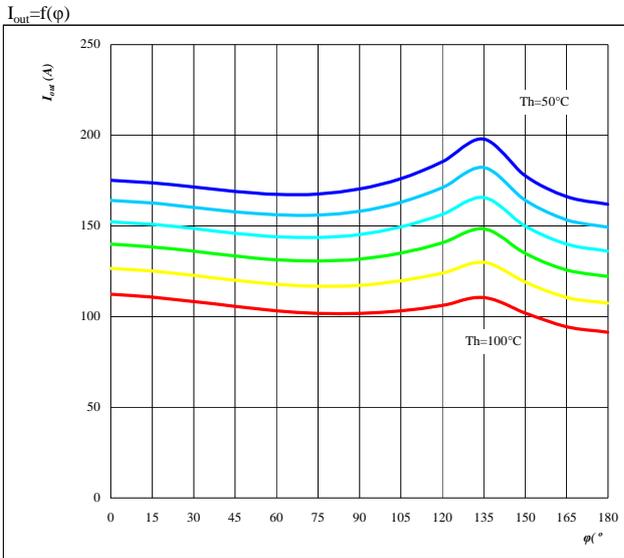
$I_{out}=f(\varphi)$

Figure 21. | Boost IGBT+FRED

Typical available output current as a function of switching frequency

Iout=f(fsw)

Conditions:	T_j=	Tjmax-25	°C		f_{sw}=	20 kHz
	DC link=	700	V			
parameter:		Heatsink temp.				
	Th from	50	°C to		100	°C
	in	10	°C		steps	
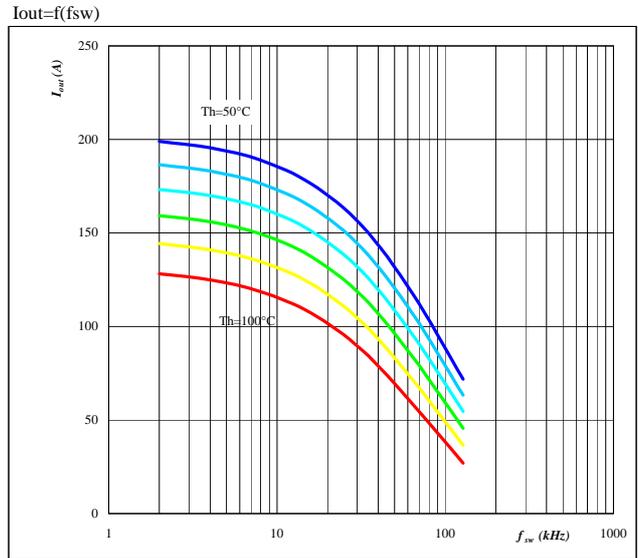
Conditions:	T_j=	Tjmax-25	°C		φ= 90°	
	DC link=	700	V			
parameter:		Heatsink temp.				
	Th from	50	°C to		100	°C
	in	10	°C		steps	

Figure 22. | Boost IGBT+FRED

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

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

Conditions:	T_j=	Tjmax-25	°C
	DC link=	700	V
	T_h=	80	°C

flowNPC1	NPC Application	600V/150A
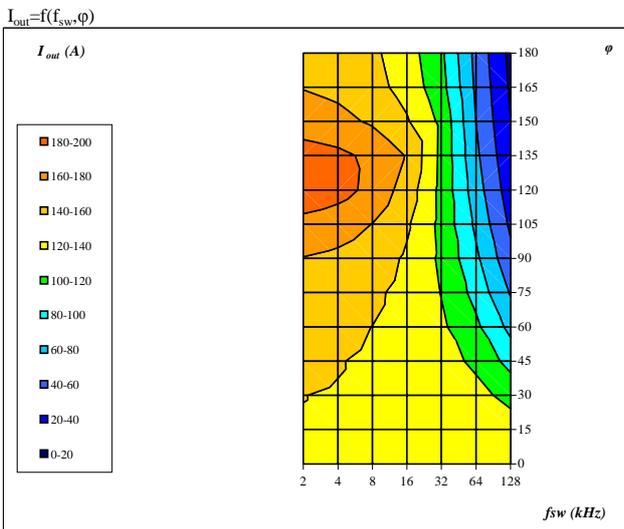
Figure 23. per MODULE

Typical available output current as a function of heat sink temperature
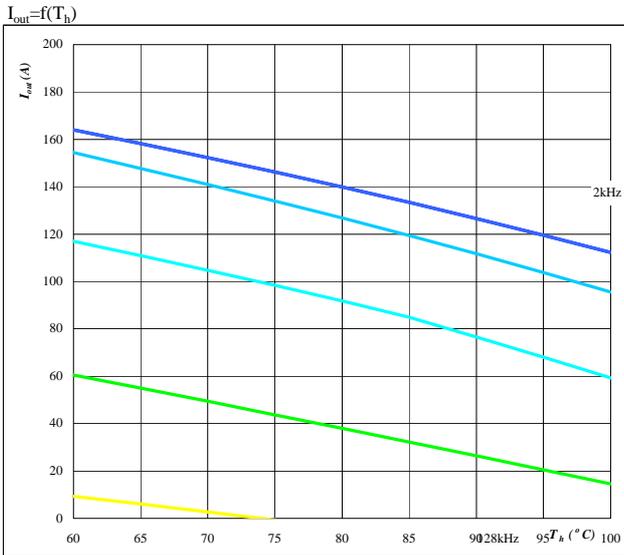
$I_{out}=f(T_h)$

Conditions:
- $T_j=$ Tjmax-25 °C
- DC link= 700 V
- φ= 0 °

parameter: Switching freq.

fsw 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

$I_{out}=f(φ)$
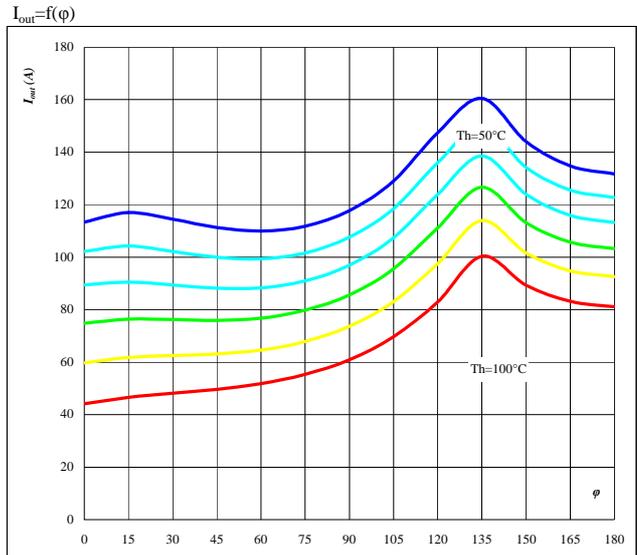
Conditions:
- $T_j=$ Tjmax-25 °C
- DC link= 700 V
- $f_{sw}=$ 20 kHz

parameter: Heatsink temp.

Th from 50 °C to 100

in 10 °C steps

Figure 25. per MODULE

Typical available output current as a function of switching frequency
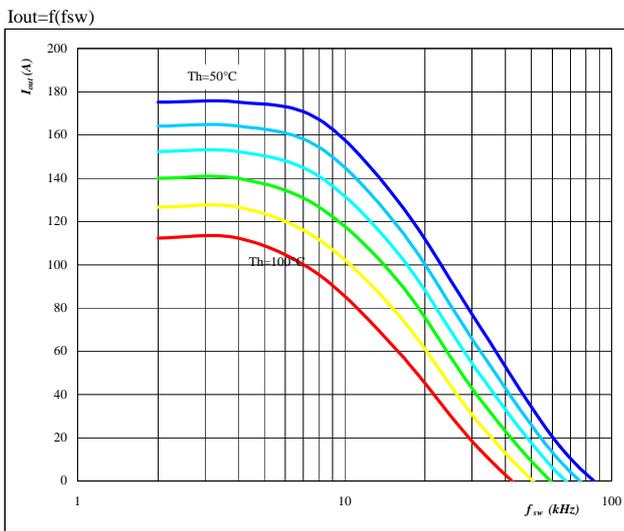
Iout=f(fsw)

Conditions:
- $T_j=$ Tjmax-25 °C   φ= 0 °
- DC link= 700 V

parameter: Heatsink temp.

Th from 50 °C to 100

in 10 °C steps

Figure 26. per MODULE

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

$I_{out}=f(f_{sw},φ)$

Conditions:
- $T_j=$ Tjmax-25 °C
- DC link= 700 V
- $T_h=$ 80 °C

flowNPC1	NPC Application	600V/150A
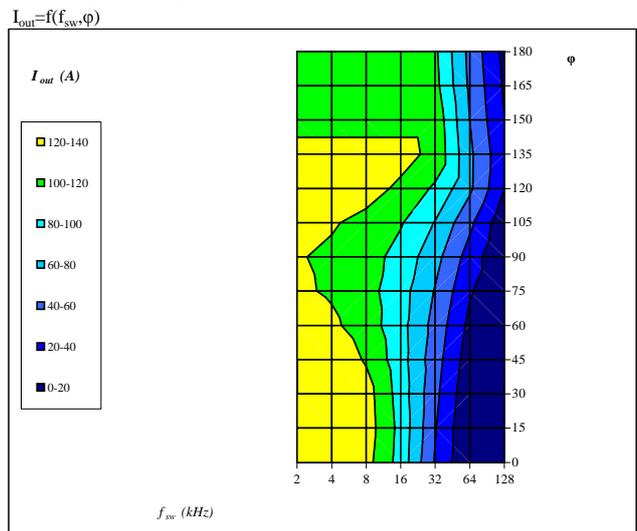
Figure 27.	per MODULE

Typical efficiency as a function of output power
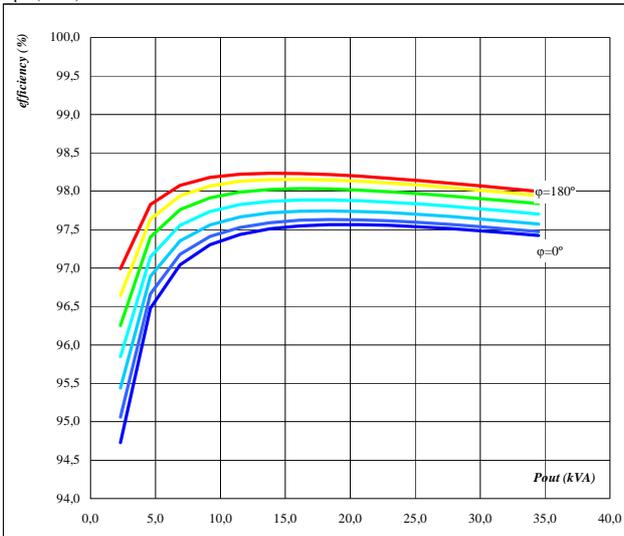
η=f(Pout)

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

parameter: phase displacement

φ from 0 ° to 180 °

in steps of 30 °

Figure 28.	per MODULE

Typical efficiency as a function of output power

η=f(Pout)
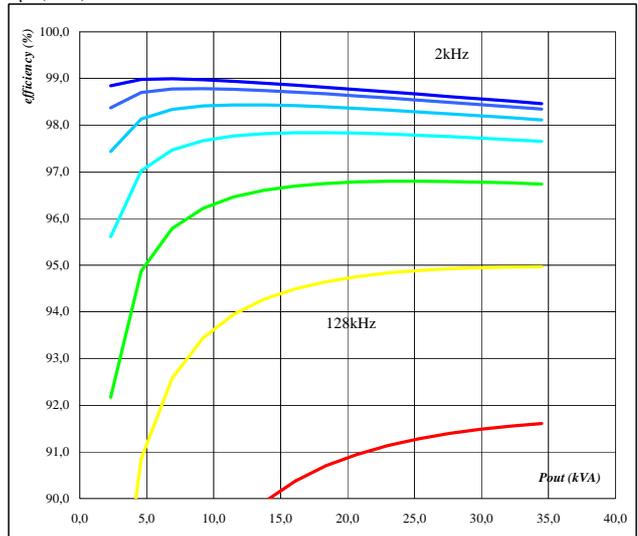
Conditions:
T_j=	150	°C		φ= 0 °	
DC link=	700	V			

parameter: Switching freq.

fsw 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)
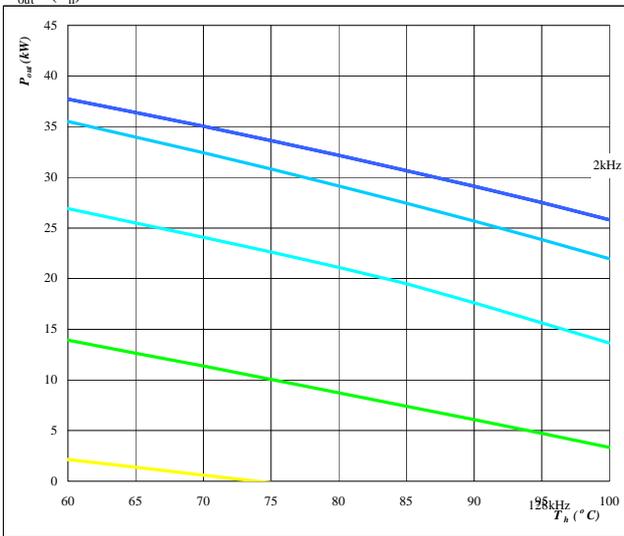
Conditions:
T_j=	Tjmax-25	°C	
	DC link=	700	V
	φ=	0	°

parameter: Switching freq.

fsw from 2 kHz to 128 kHz

in steps of factor 2

| flowNPC1	NPC Application	600V/150A
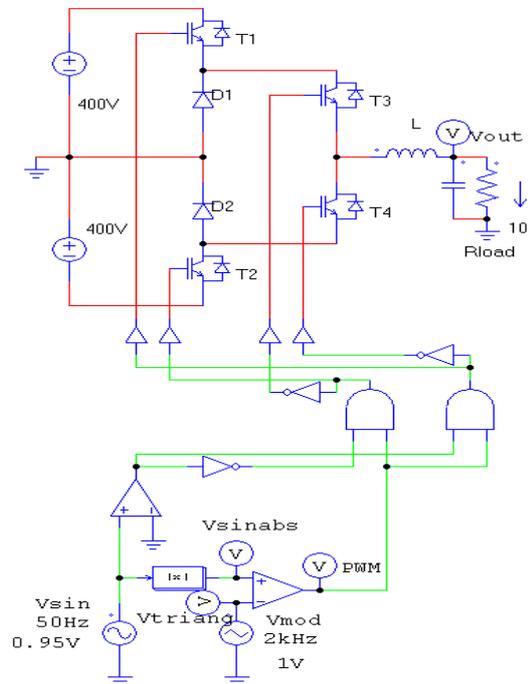
Figure 30. per MODULE
**Typical loss distribution as a function of
output current**
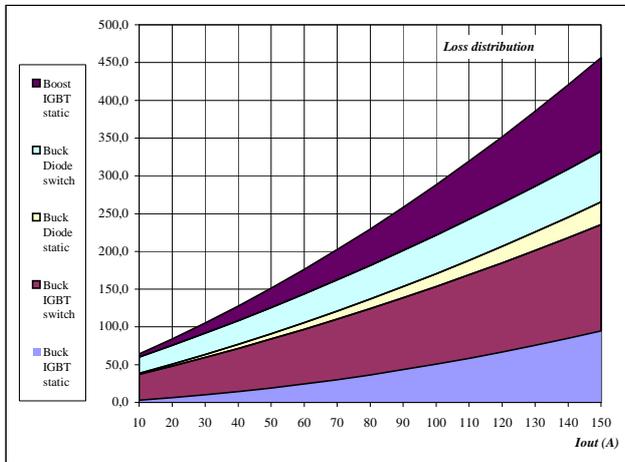
$P_{out}=f(T_h)$

Conditions:

	$T_j=$	150	°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:

	$T_j=$	150	°C
	$f_{sw}=$	20	kHz
DC link=		700	V
$\varphi=$		0	°