flow3xMNPC 1 — mixed voltage NPC Application — 1200V/40A

General conditions

Half Bridge IGBT		
V_{GEon}	=	15 V
V_{GEoff}	=	-15 V
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

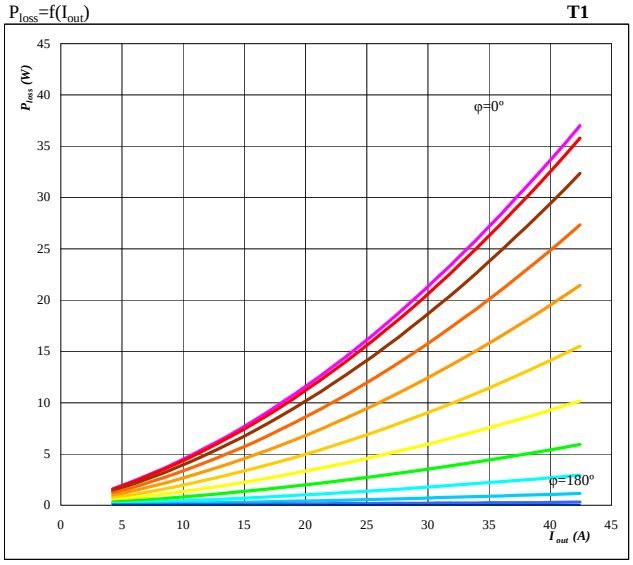
Vout= 230 VAC

Neutral Point IGBT		
V_{GEon}	=	15 V
V_{GEoff}	=	-15 V
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1. Half Bridge IGBT

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

$P_{loss}=f(I_{out})$ T1

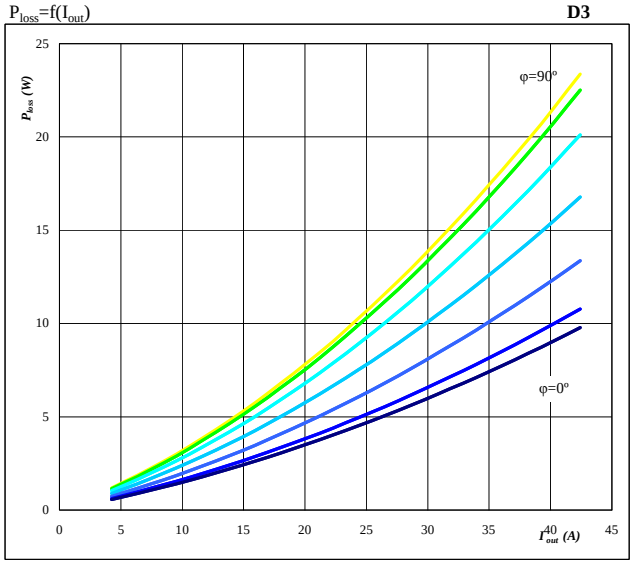


Conditions: T_j= 125 °C
parameter: φ from 0° to 180°
in 12 steps

Figure 2. Neutral Point FWD

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

$P_{loss}=f(I_{out})$ D3

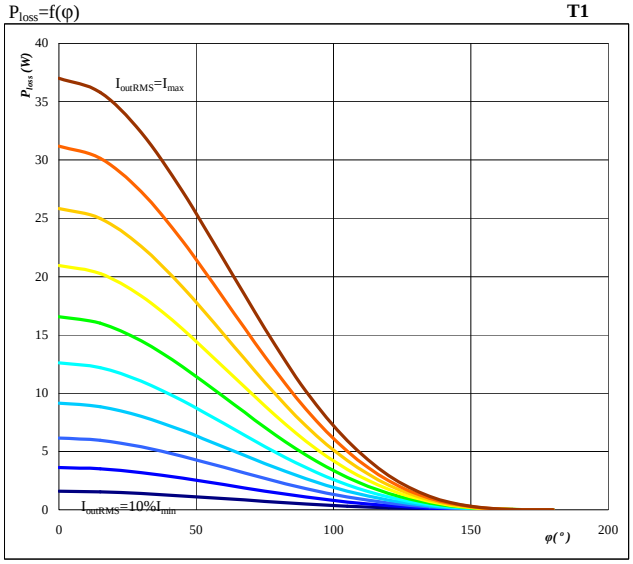


Conditions: T_j= 125 °C
parameter: φ from 0° to 180°
in 12 steps

Figure 3. Half Bridge IGBT

Typical average static loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$ T1

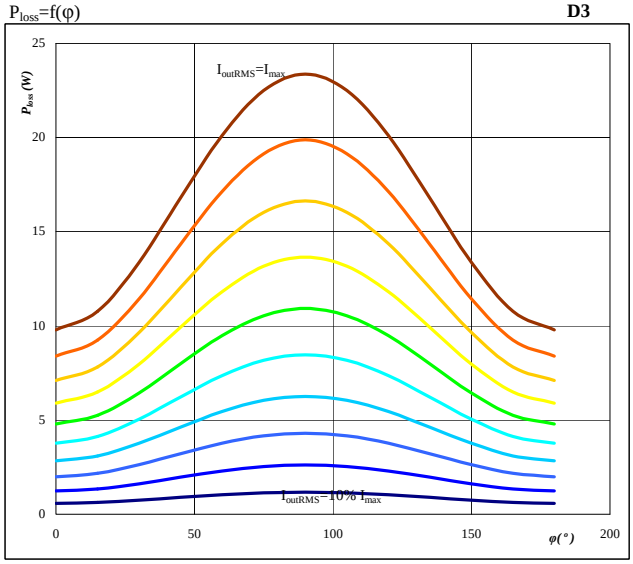


Conditions: T_j= 125 °C
parameter: I_{oRMS} from 4,24 A to 42 A
in steps of 4 A

Figure 4. Neutral Point FWD

Typical average static loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$ D3



Conditions: T_j= 125 °C
parameter: I_{oRMS} from 4,24 A to 42 A
in steps of 4 A

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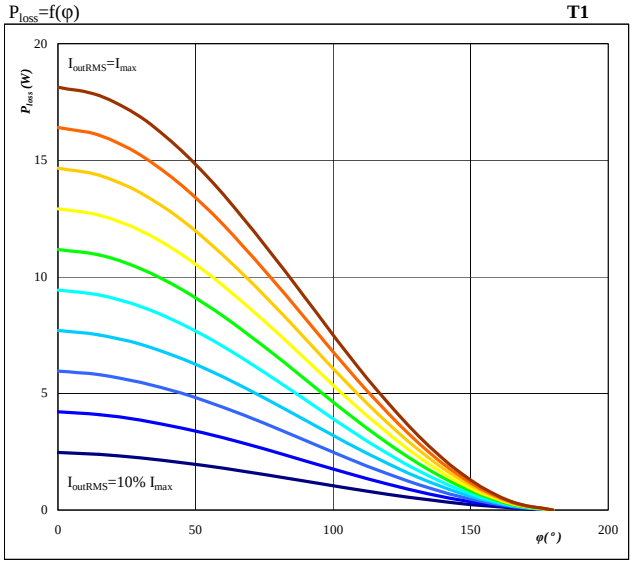
Figure 5. Half Bridge IGBT

Typical average switching loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$ **T1**

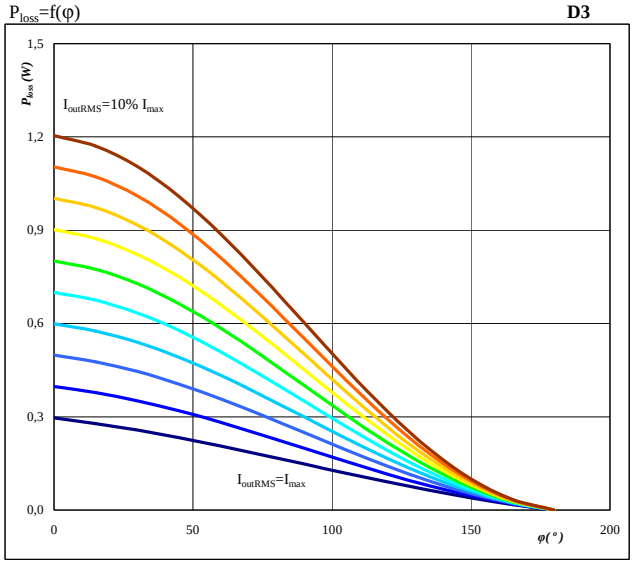


Conditions:			
	T_j=	125	°C
	f_{sw}=	16	kHz
	DC link=	700	V
parameter:	I_{oRMS}	from 4,24 A	to 42 A
	in steps of	4 A	

Figure 6. Neutral Point FWD

Typical average switching loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$ **D3**

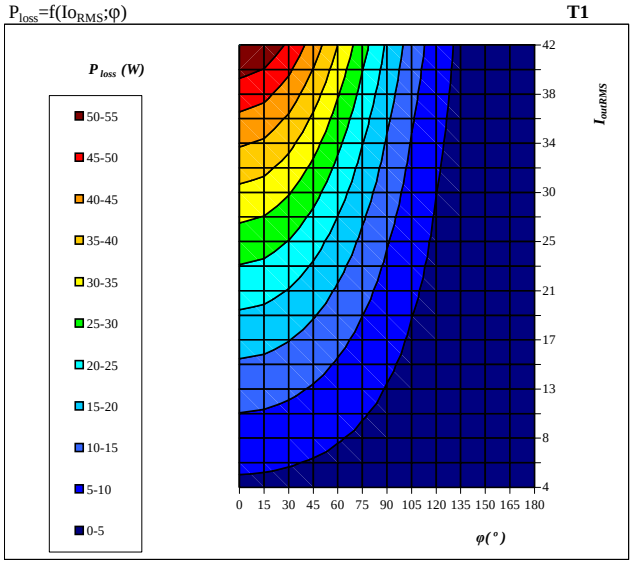


Conditions:			
	T_j=	125	°C
	f_{sw}=	16	kHz
	DC link=	700	V
parameter:	I_{oRMS}	from 4,24 A	to 42 A
	in steps of	4 A	

Figure 7. Half Bridge IGBT

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

$P_{loss}=f(Io_{RMS};\varphi)$ **T1**

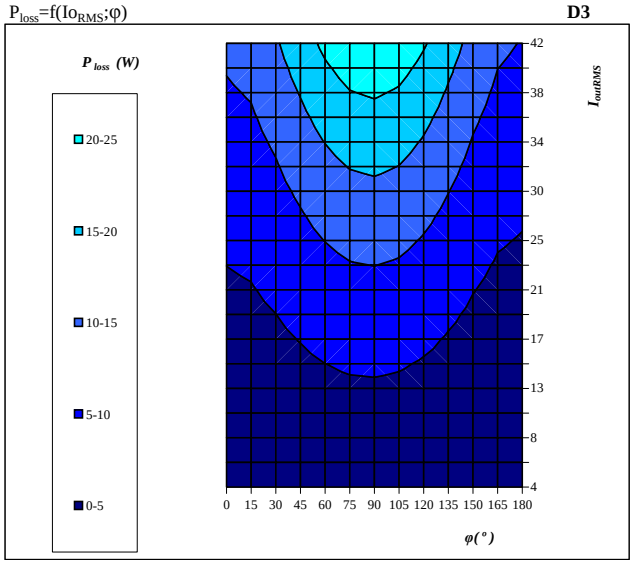


Conditions:			
	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	16	kHz

Figure 8. Neutral Point FWD

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

$P_{loss}=f(Io_{RMS};\varphi)$ **D3**

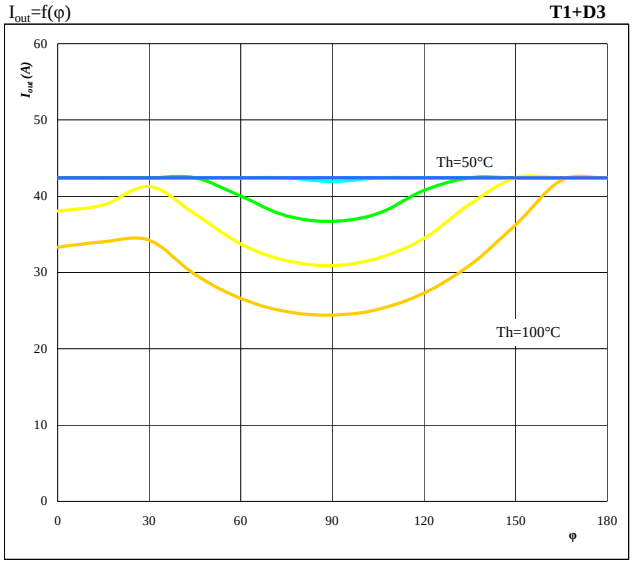


Conditions:			
	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	16	kHz

Figure 9. for Half Bridge IGBT+ Neutral Point FWD

Typical available output current as a function of phase displacement φ

$I_{out}=f(\varphi)$ **T1+D3**

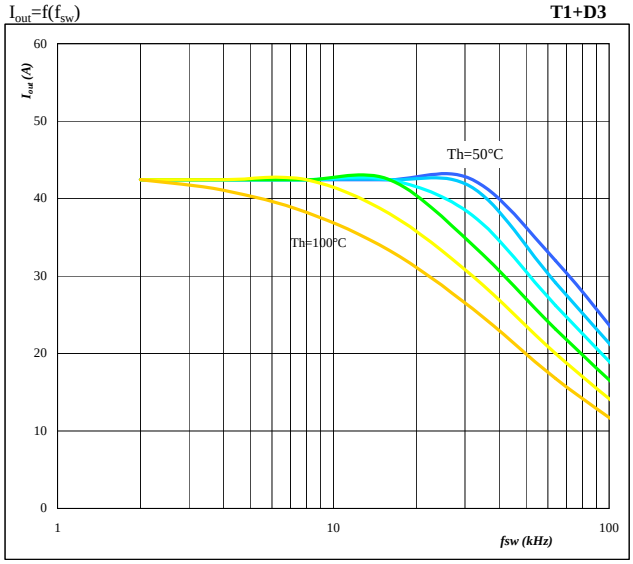


Conditions:	T_j=	Tjmax-25	°C		f_{sw}=	16 kHz
	DC link=	700	V			
parameter:	Heatsink temp.					
	T_h from	50	°C to	100	°C	
	in	10	°C	steps		

Figure 10. for Half Bridge IGBT+ Neutral Point FWD

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

$I_{out}=f(f_{sw})$ **T1+D3**

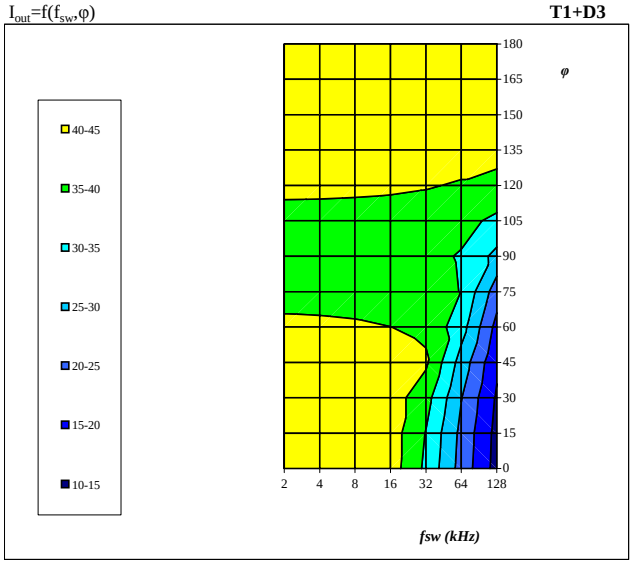


Conditions:	T_j=	Tjmax-25	°C		φ=	0 °
	DC link=	700	V			
parameter:	Heatsink temp.					
	T_h from	50	°C to	100	°C	
	in	10	°C	steps		

Figure 11. for Half Bridge IGBT+ Neutral Point FWD

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

$I_{out}=f(f_{sw},\varphi)$ **T1+D3**



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

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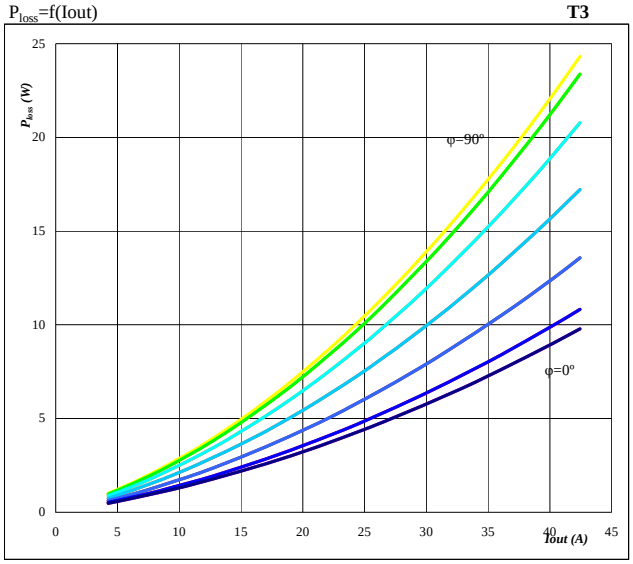
Figure 12. Neutral Point IGBT

Typical average static loss as a function of output current

$P_{loss}=f(Iout)$ **T3**

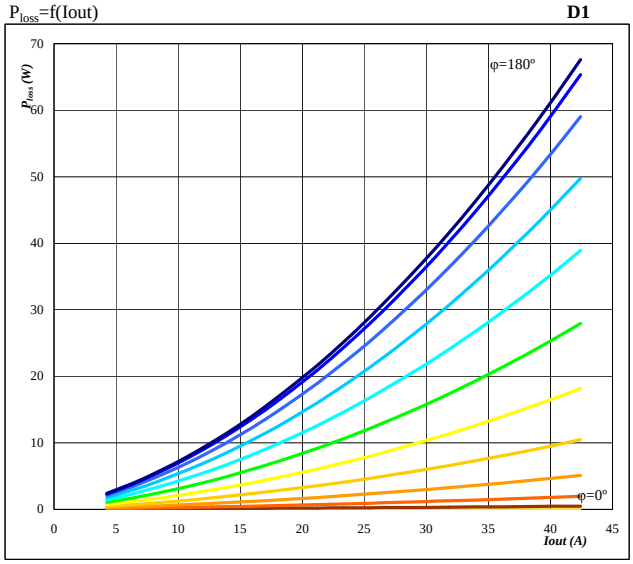


Conditions: T_j= 125 °C
parameter: **φ** from 0° to 180°
in 12 steps

Figure 13. Half Bridge FWD

Typical average static loss as a function of output current

$P_{loss}=f(Iout)$ **D1**

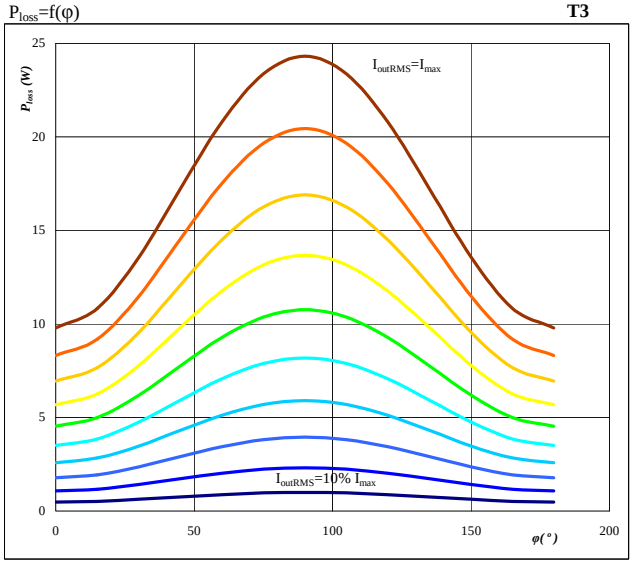


Conditions: T_j= 125 °C
parameter: **φ** from 0° to 180°
in 12 steps

Figure 14. Neutral Point IGBT

Typical average static loss as a function of phase displacement

$P_{loss}=f(\varphi)$ **T3**

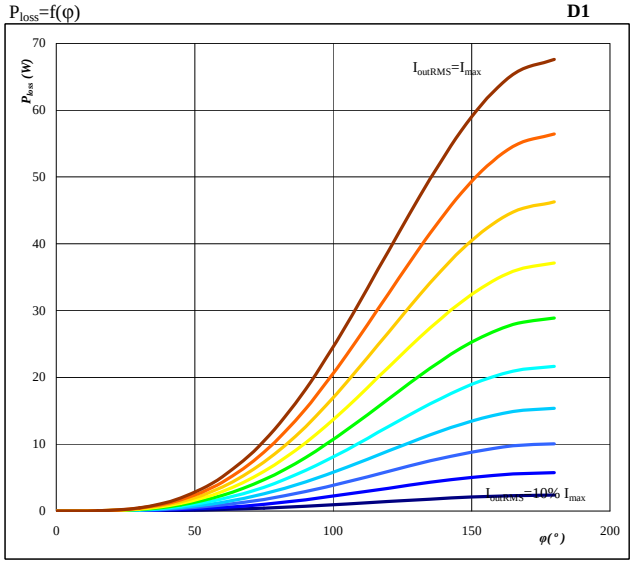


Conditions: T_j= 125 °C
parameter: I_{oRMS} from 4 A to 42 A
in steps of 4 A

Figure 15. Half Bridge FWD

Typical average static loss as a function of phase displacement

$P_{loss}=f(\varphi)$ **D1**



Conditions: T_j= 125 °C
parameter: I_{oRMS} from 4 A to 42 A
in steps of 4 A

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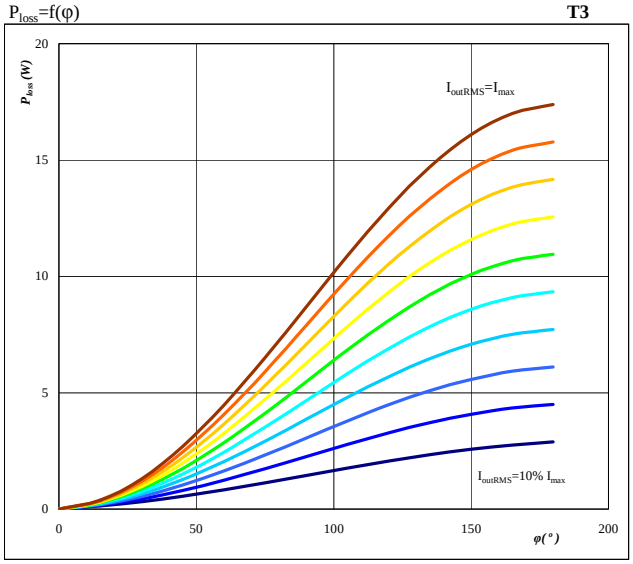
Figure 16. Neutral Point IGBT

Typical average switching loss as a function of phase displacement

$P_{loss}=f(\varphi)$ T3

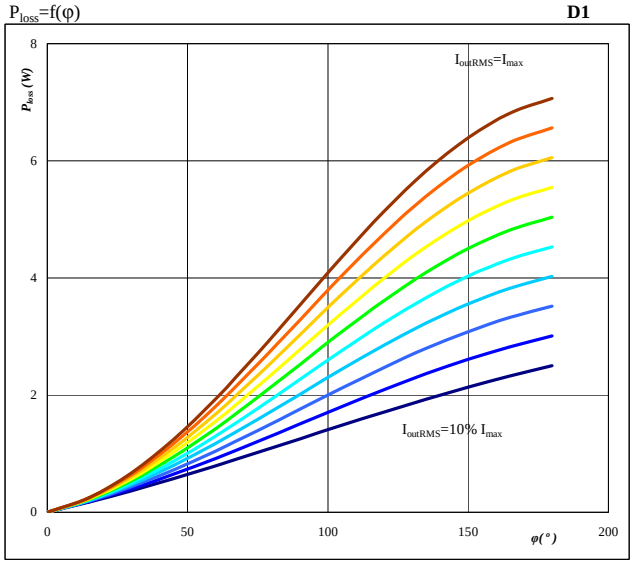


Conditions:	T_j=	125	°C		f_{sw}=	16 kHz
	DC link=	700	V			
parameter:	I_{oRMS}	from	4 A	to	42 A	
		in steps of	4 A	A		

Figure 17. Half Bridge FWD

Typical average switching loss as a function of phase displacement

$P_{loss}=f(\varphi)$ D1

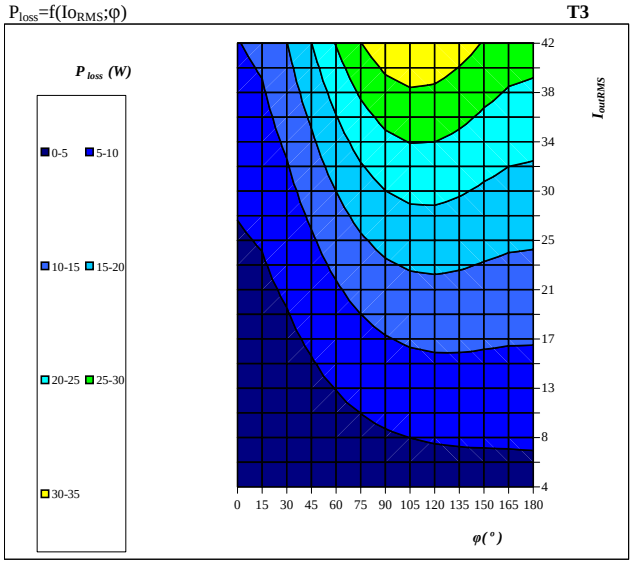


Conditions:	T_j=	125	°C		f_{sw}=	16 kHz
	DC link=	700	V			
parameter:	I_{oRMS}	from	4 A	to	42 A	
		in steps of	4 A	A		

Figure 18. Neutral Point IGBT

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

$P_{loss}=f(Io_{RMS};\varphi)$ T3

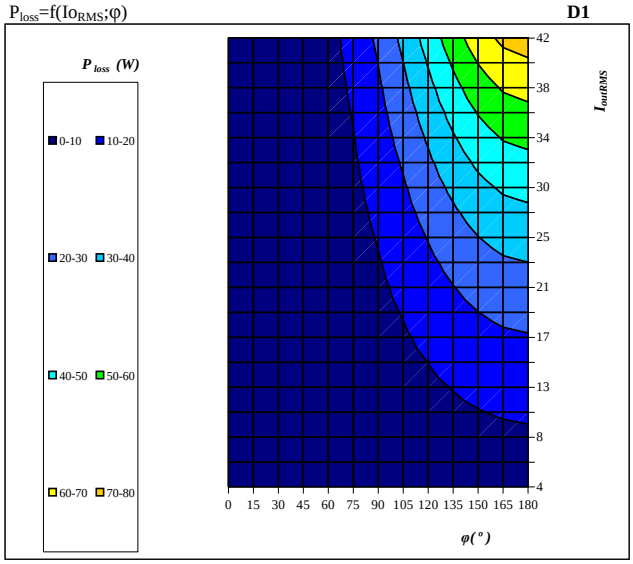


Conditions:	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	16	kHz

Figure 19. Half Bridge FWD

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

$P_{loss}=f(Io_{RMS};\varphi)$ D1



Conditions:	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	16	kHz

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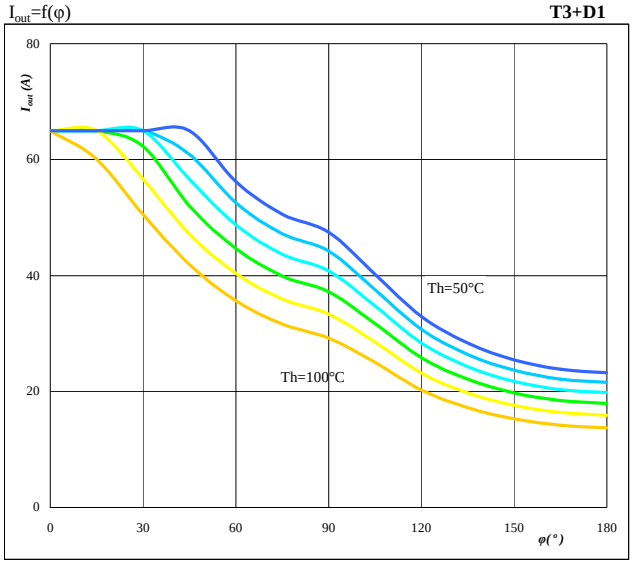
Figure 20. for Neutral Point IGBT+ Half Bridge FWD

Typical available output current as a function of of phase displacement

$I_{out}=f(\varphi)$ **T3+D1**

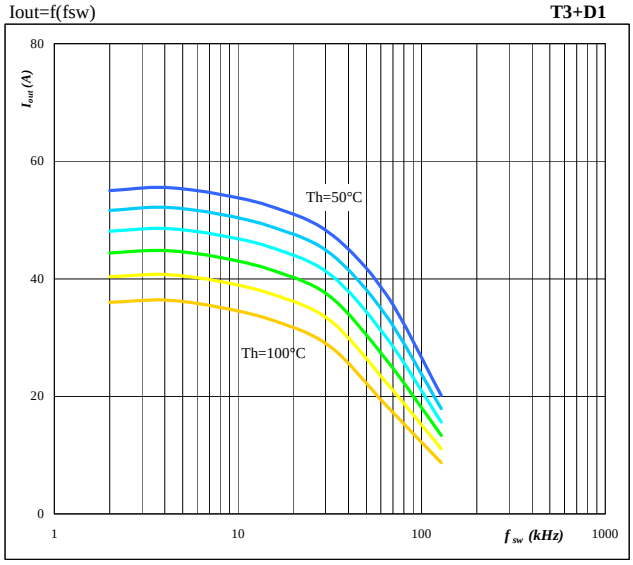


Conditions:	T_j=	Tjmax-25	°C		f_{sw}=	16 kHz
	DC link=	700	V			
parameter:	Heatsink temp.					
	Th from	50	°C to	100		°C
	in	10	°C	steps		

Figure 21. for Neutral Point IGBT+ Half Bridge FWD

Typical available output current as a function of switching frequency

Iout=f(fsw) **T3+D1**

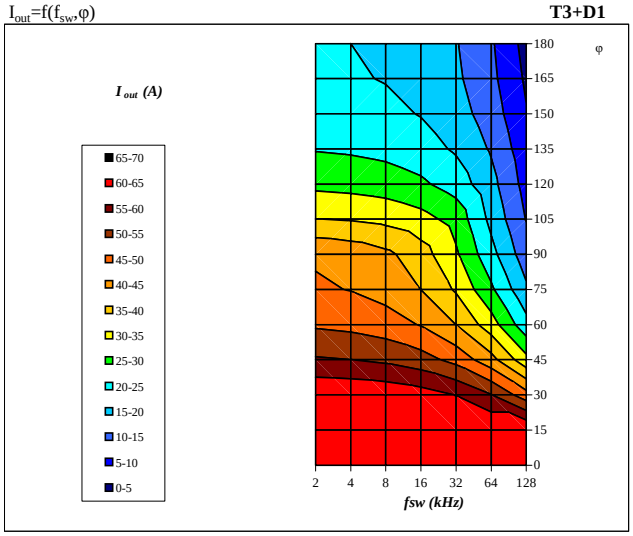


Conditions:	T_j=	Tjmax-25	°C		φ=	90°
	DC link=	700	V			
parameter:	Heatsink temp.					
	Th from	50	°C to	100		°C
	in	10	°C	steps		

Figure 22. for Neutral Point IGBT+ Half Bridge FWD

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

$I_{out}=f(f_{sw},\varphi)$ **T3+D1**

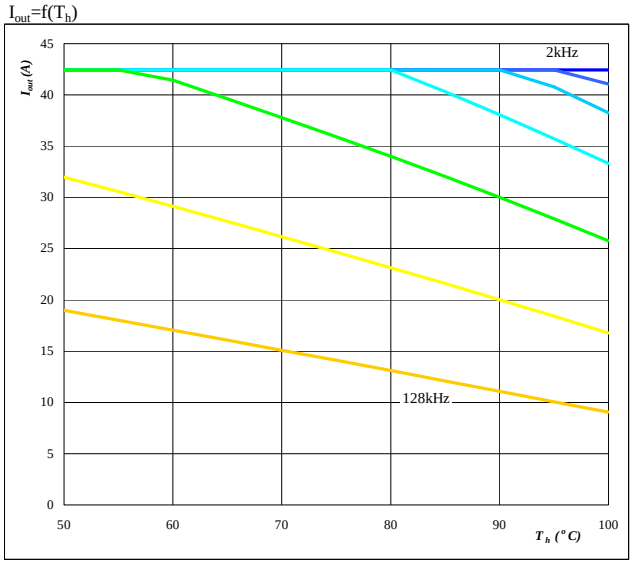


Conditions:	T_j=	Tjmax-25	°C	
	DC link=	700	V	
	T_h=	80	°C	

Figure 23. per PHASE

Typical available output current as a function of heat sink temperature

$I_{out}=f(T_h)$

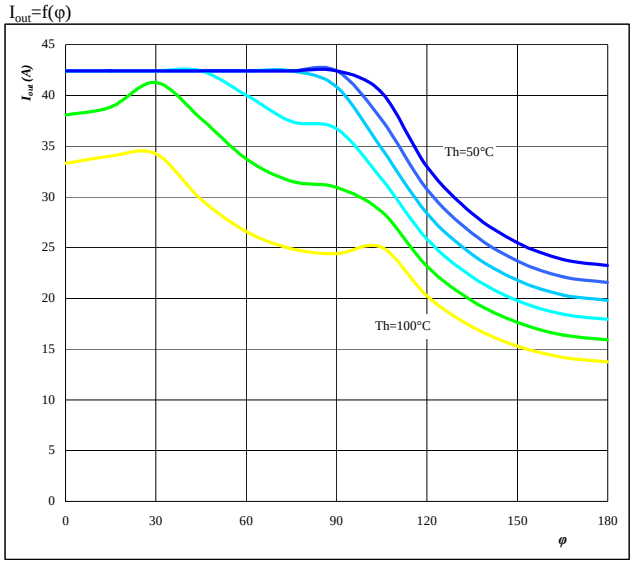


Conditions: T_j= Tjmax-25 °C
DC link= 700 V
φ= 0 °
parameter: Switching freq.
fsw from 2 kHz to 128 kHz
in steps of factor 2

Figure 24. per PHASE

Typical available output current as a function of phase displacement

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

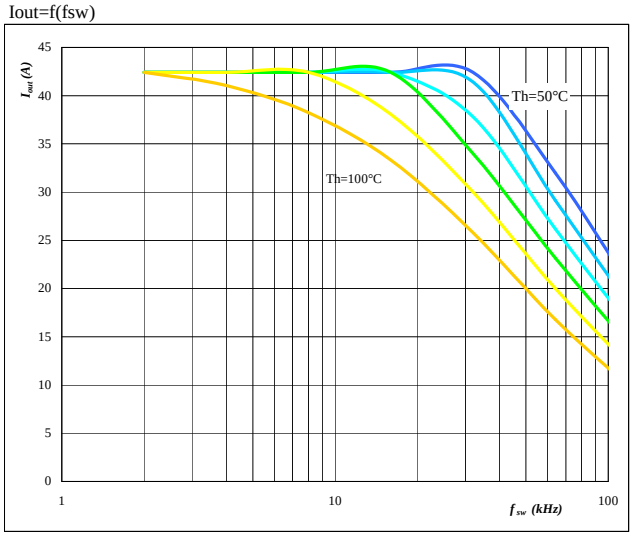


Conditions: T_j= Tjmax-25 °C
DC link= 700 V
f_{sw}= 16 kHz
parameter: Heatsink temp.
Th from 50 °C to 100
in 10 °C steps

Figure 25. per PHASE

Typical available output current as a function of switching frequency

Iout=f(fsw)

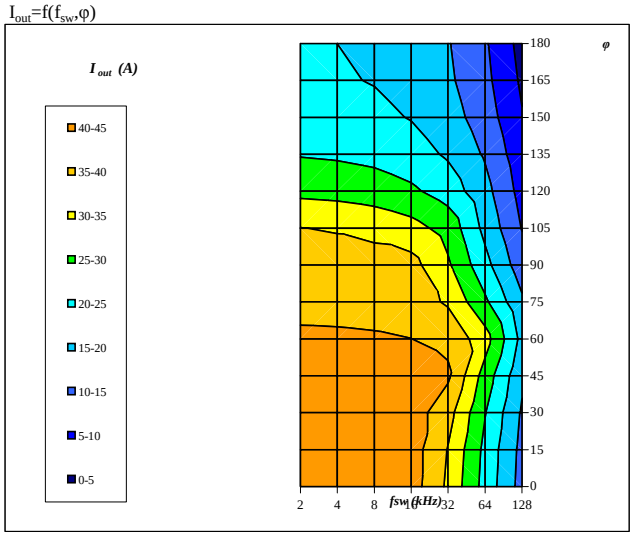


Conditions: T_j= Tjmax-25 °C φ= 0 °
DC link= 700 V
parameter: Heatsink temp.
Th from 50 °C to 100
in 10 °C steps

Figure 26. per PHASE

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

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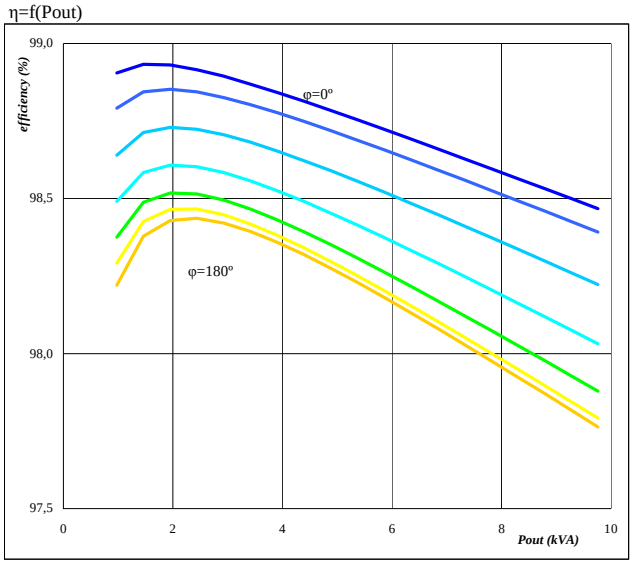
Figure 27. per PHASE

Typical efficiency as a function of output power

η=f(Pout)

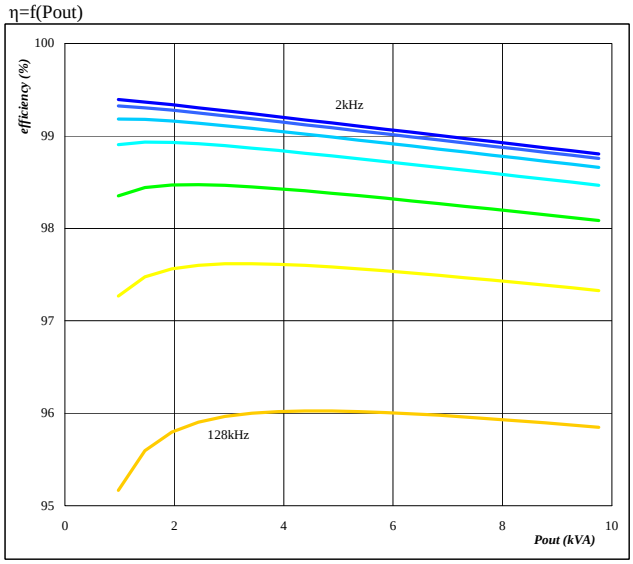


Conditions: T_j= 125 °C
f_{sw}= 16 kHz
DC link= 700 V
parameter: phase displacement
φ from 0 ° to 180 °
in steps of 30 °

Figure 28. per PHASE

Typical efficiency as a function of output power

η=f(Pout)

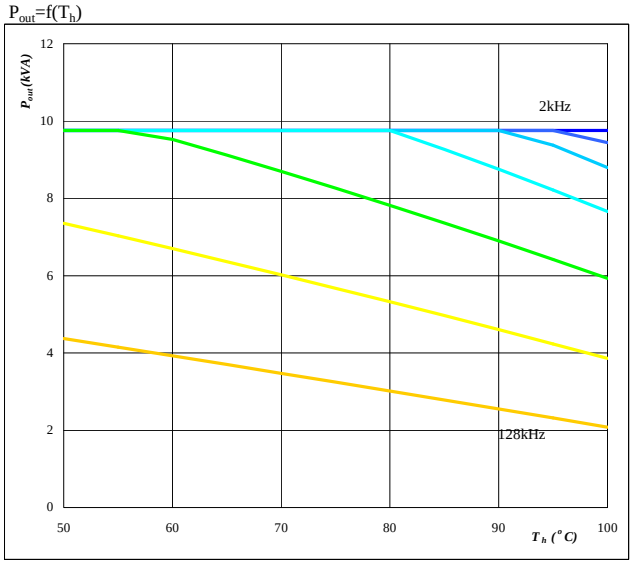


Conditions: T_j= 125 °C φ= 0 °
DC link= 700 V
parameter: Switching freq.
fsw from 2 kHz to 128 kHz
in steps of factor 2

Figure 29. per PHASE

Typical available output power as a function of heat sink temperature

$P_{out}=f(T_h)$

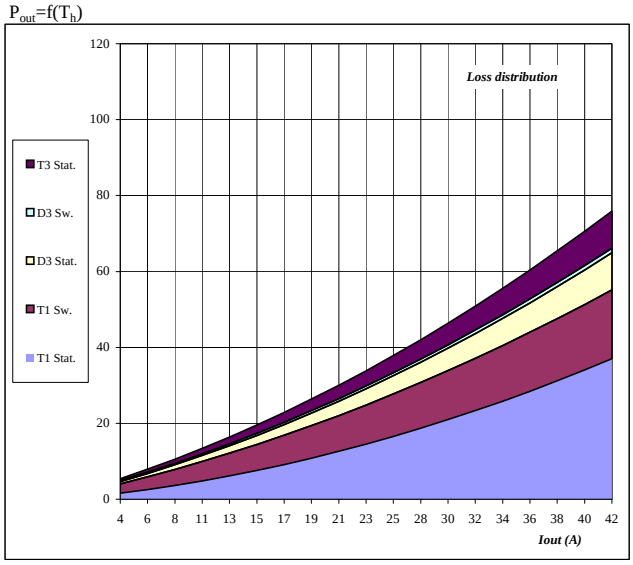


Conditions: T_j= Tjmax-25 °C
DC link= 700 V
φ= 0 °
parameter: Switching freq.
fsw from 2 kHz to 128 kHz
in steps of factor 2

Figure 30. per PHASE

Typical loss distribution as a function of output current

$P_{out}=f(T_h)$

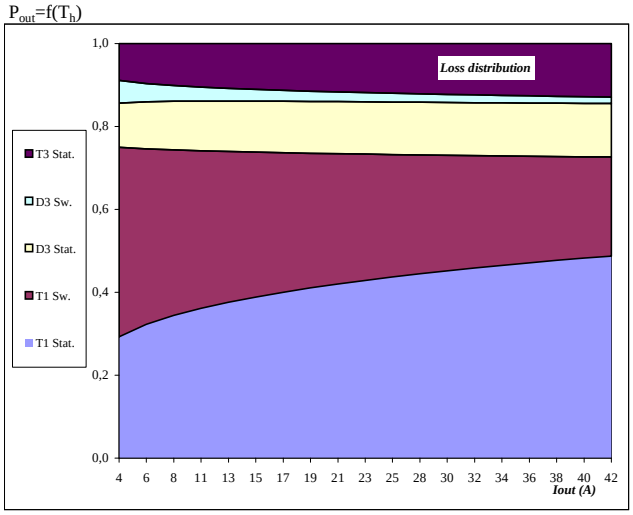


Conditions: T_j= 125 °C
f_{sw}= 16 kHz
DC link= 700 V
φ= 0 °

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}=	16	kHz
DC link=	700	V
φ=	0 °