flowMNPC 4w — mixed voltage NPC Application — 1200 V / 27mΩ

General conditions

half bridge MOSFET		
V_{GEon}	=	16 V
V_{GEoff}	=	-5 V
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

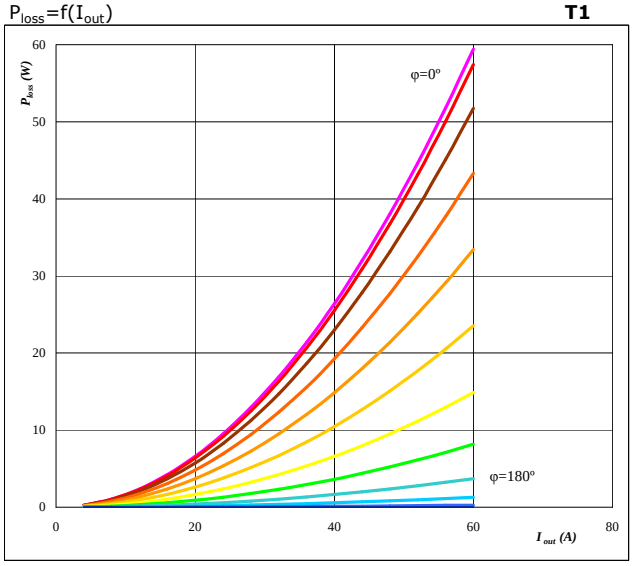
V_{out}= 230 VAC

neutral point IGBT		
V_{GEon}	=	15 V
V_{GEoff}	=	-15 V
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

Figure 1. half bridge MOSFET

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

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

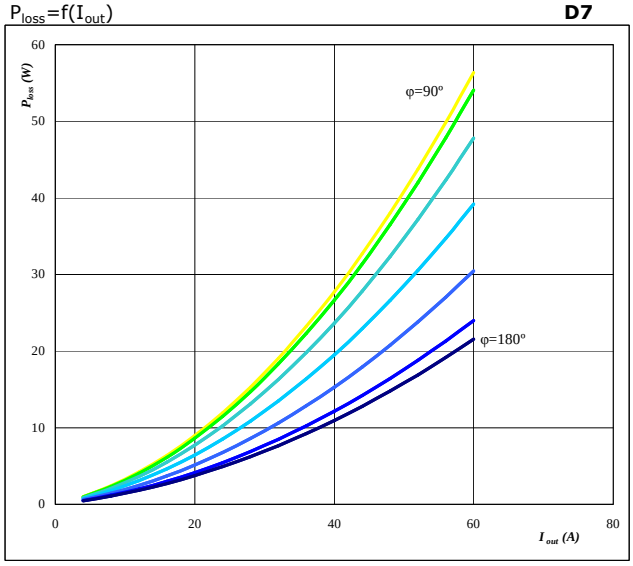


Conditions T_j= 125 °C
parameter **φ** from 0° to 180°
in 12 steps

Figure 2. neutral point FWD

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

$P_{loss}=f(I_{out})$ **D7**

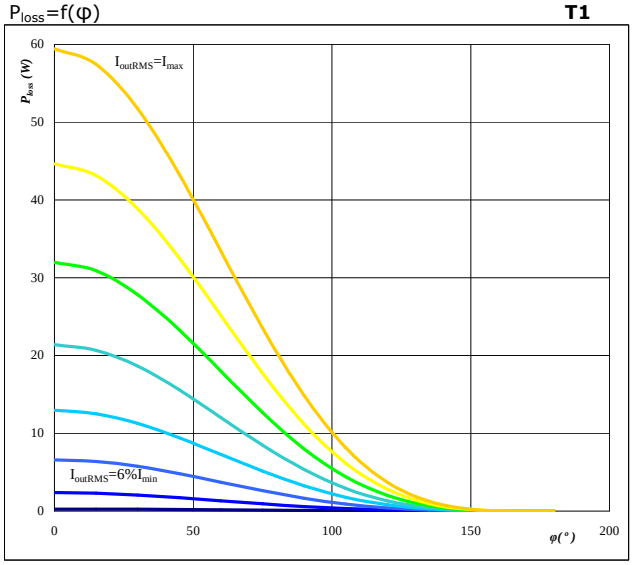


Conditions T_j= 125 °C
parameter **φ** from 0° to 180°
in 12 steps

Figure 3. half bridge MOSFET

Typical average static loss as a function of phase displacement φ

$P_{loss}=f(φ)$ **T1**

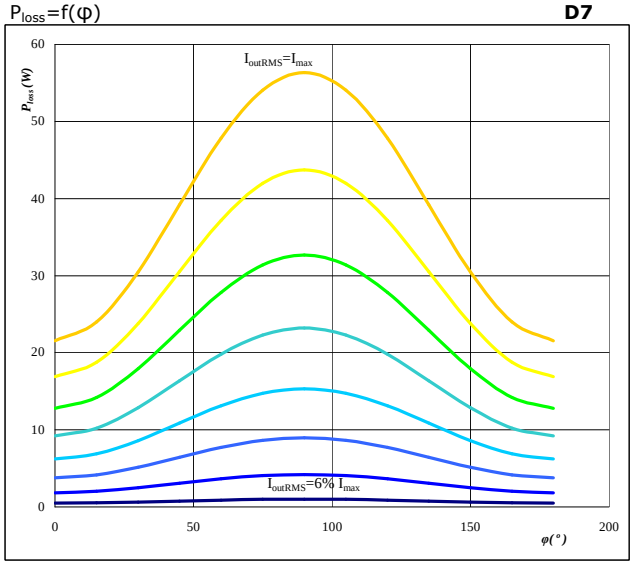


Conditions T_j= 125 °C
parameter I_{oRMS} from 4 A to 60 A
in steps of 8 A

Figure 4. neutral point FWD

Typical average static loss as a function of phase displacement φ

$P_{loss}=f(φ)$ **D7**

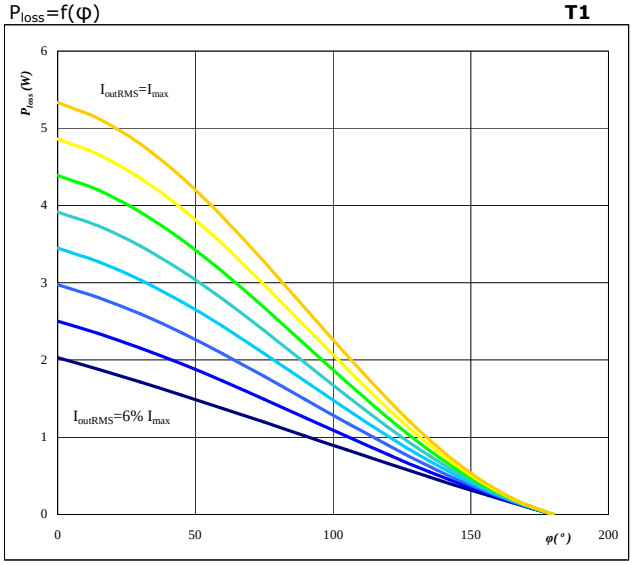


Conditions T_j= 125 °C
parameter I_{oRMS} from 4 A to 60 A
in steps of 8 A

Figure 5. half bridge MOSFET

Typical average switching loss as a function of phase displacement φ

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

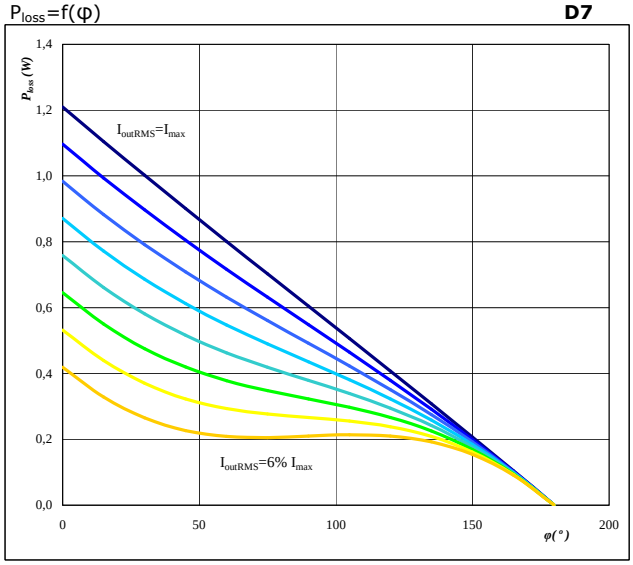


Conditions T_j= 125 °C
f_{sw}= 50 kHz
DC link= 700 V
parameter I_{oRMS} from 4 A to 60 A
in steps of 8 A

Figure 6. neutral point FWD

Typical average switching loss as a function of phase displacement φ

$P_{loss}=f(\varphi)$ **D7**

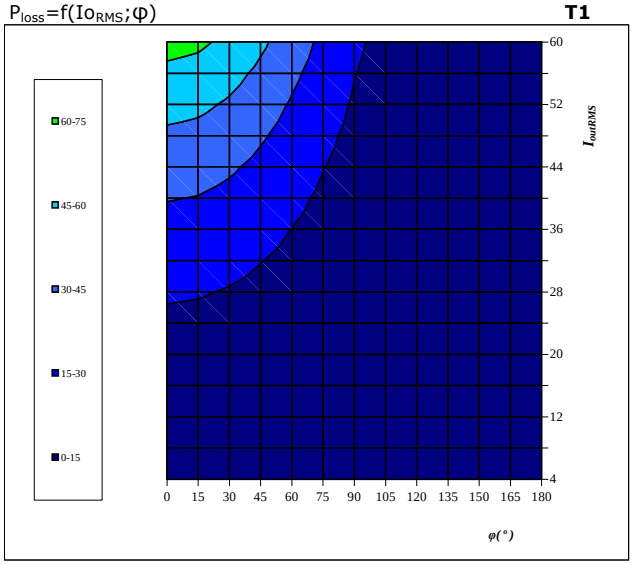


Conditions T_j= 125 °C
f_{sw}= 50 kHz
DC link= 700 V
parameter I_{oRMS} from 4 A to 60 A
in steps of 8 A

Figure 7. half bridge MOSFET

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

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

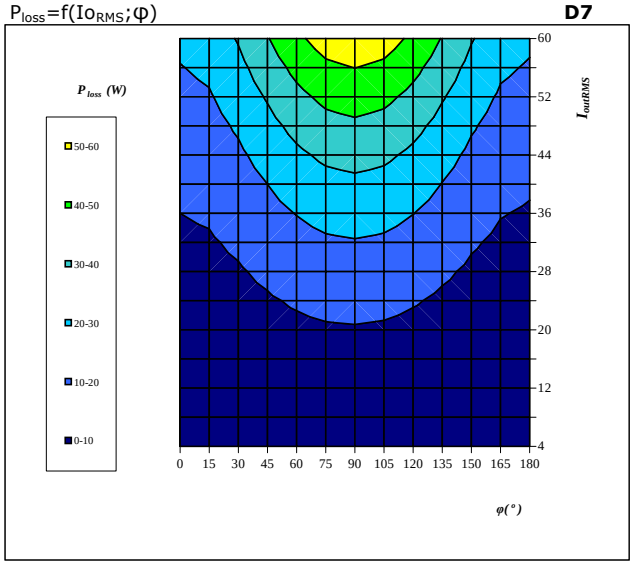


Conditions T_j= 125 °C
DC link= 700 V
f_{sw}= 50 kHz

Figure 8. neutral point FWD

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

$P_{loss}=f(Io_{RMS};\varphi)$ **D7**

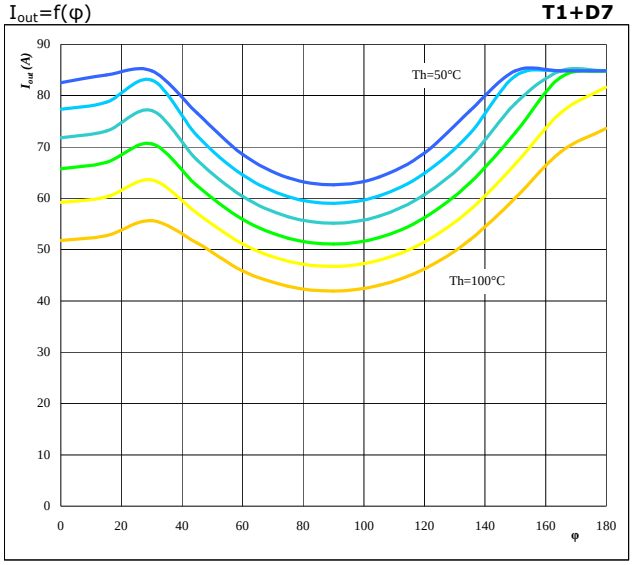


Conditions T_j= 125 °C
DC link= 700 V
f_{sw}= 50 kHz

Figure 9. for half bridge MOSFET+ neutral point FWD

Typical available output current as a function of phase displacement φ

$I_{out}=f(\varphi)$ **T1+D7**

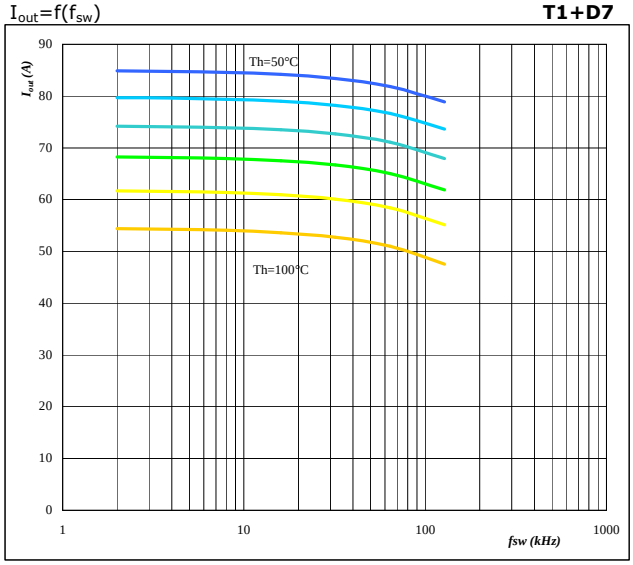


Conditions	T_j=	150	°C	f_{sw}=	50 kHz
	DC link=	700	V		
parameter:	Heatsink temp.				
	T_h from	50	°C to	100	°C
	in	10	°C	steps	

Figure 10. for half bridge MOSFET+ neutral point FWD

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

$I_{out}=f(f_{sw})$ **T1+D7**

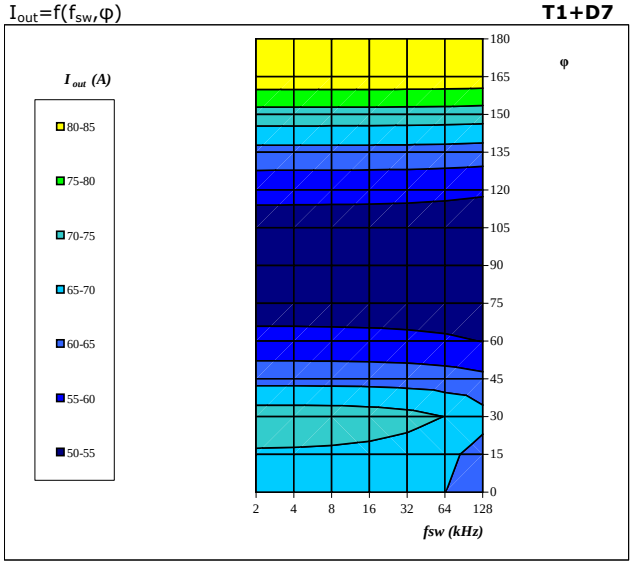


Conditions	T_j=	150	°C	φ=	0 °
	DC link=	700	V		
parameter	Heatsink temp.				
	T_h from	50	°C to	100	°C
	in	10	°C	steps	

Figure 11. for half bridge MOSFET+ neutral point FWD

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

$I_{out}=f(f_{sw},\varphi)$ **T1+D7**

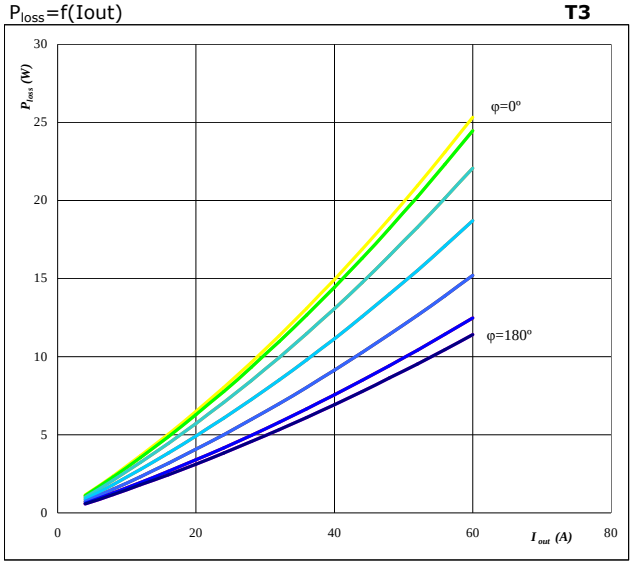


Conditions	T_j=	150	°C
	DC link=	700	V
	T_h=	80	°C

Figure 12. neutral point IGBT

Typical average static loss as a function of output current

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

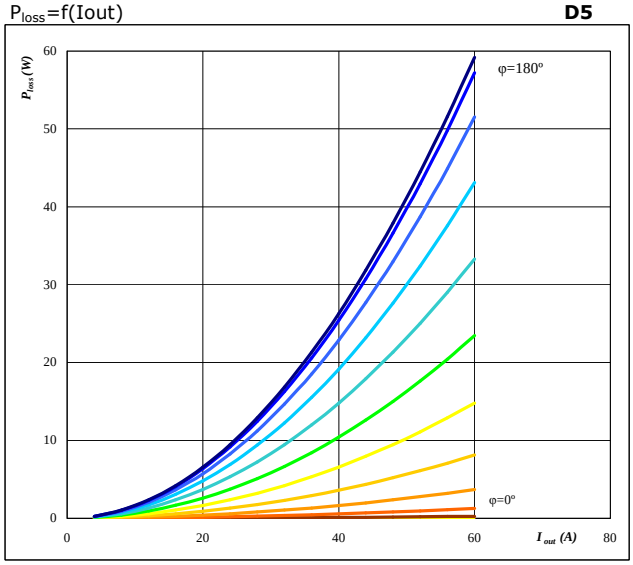


Conditions					
parameter	T_j=	125	°C		
	φ	from	0°	to	180°
		in	12	steps	

Figure 13. half bridge FWD

Typical average static loss as a function of output current

P_{loss}=f(Iout) **D5**

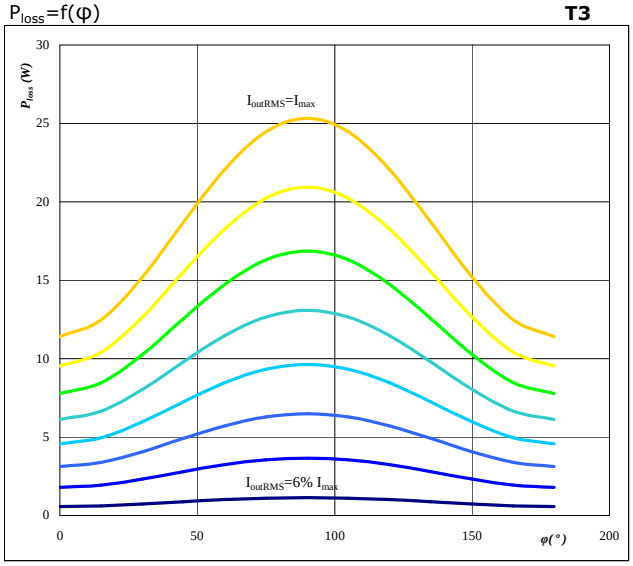


Conditions					
parameter	T_j=	125	°C		
	φ	from	0°	to	180°
		in	12	steps	

Figure 14. neutral point IGBT

Typical average static loss as a function of phase displacement

P_{loss}=f(φ) **T3**

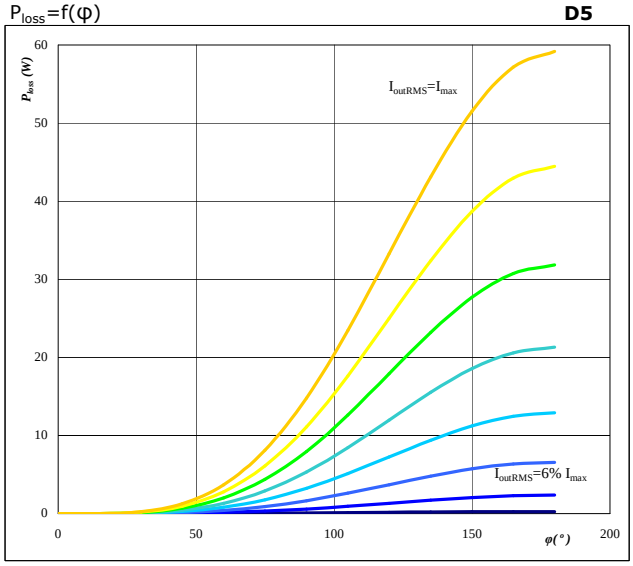


Conditions					
parameter	T_j=	125	°C		
	I_{oRMS}	from	4 A	to	60 A
		in steps of	8 A		

Figure 15. half bridge FWD

Typical average static loss as a function of phase displacement

P_{loss}=f(φ) **D5**

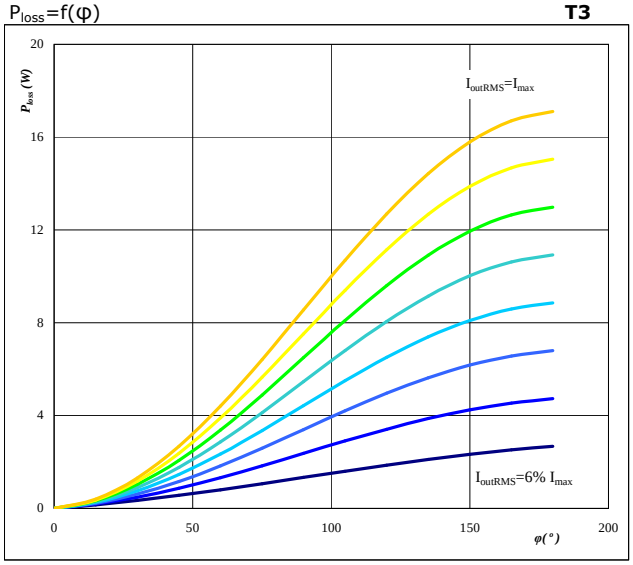


Conditions					
parameter	T_j=	125	°C		
	I_{oRMS}	from	4 A	to	60 A
		in steps of	8 A		

Figure 16. neutral point IGBT

Typical average switching loss as a function of phase displacement

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

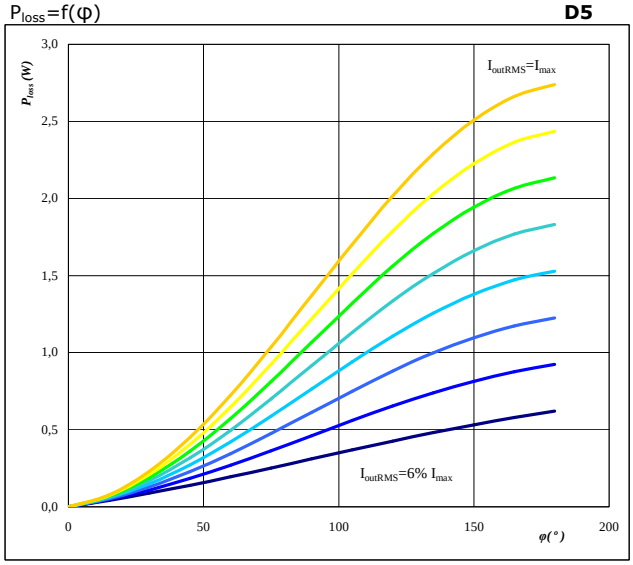


Conditions	T_j=	125	°C	f_{sw}=	50	kHz
	DC link=	700	V			
parameter	I_{oRMS}	from	4 A	to	60 A	
		in steps of	8 A		A	

Figure 17. half bridge FWD

Typical average switching loss as a function of phase displacement

$P_{loss}=f(\varphi)$ **D5**

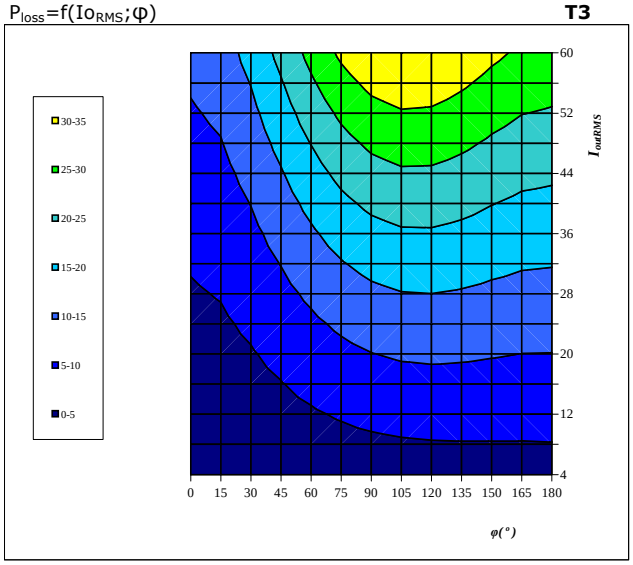


Conditions	T_j=	125	°C	f_{sw}=	50	kHz
	DC link=	700	V			
parameter	I_{oRMS}	from	4 A	to	60 A	
		in steps of	8 A		A	

Figure 18. neutral point IGBT

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

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

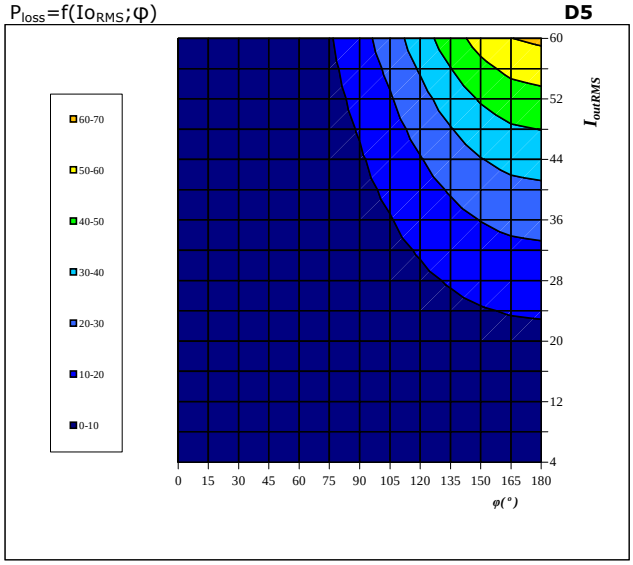


Conditions	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	50	kHz

Figure 19. half bridge FWD

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

$P_{loss}=f(Io_{RMS};\varphi)$ **D5**

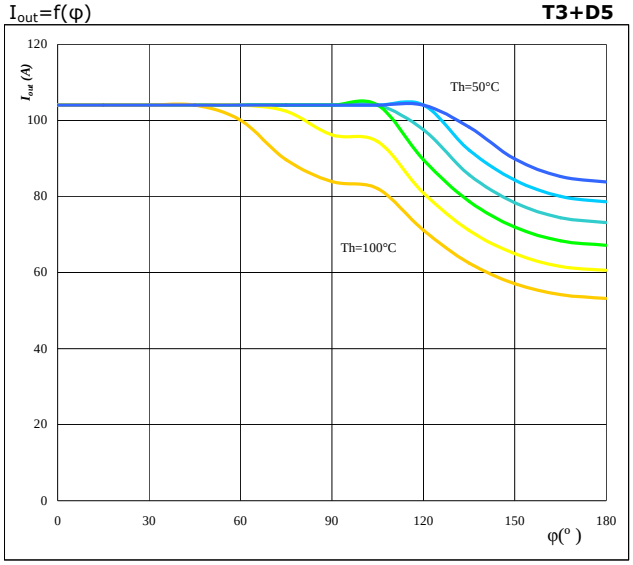


Conditions	T_j=	125	°C
	DC link=	700	V
	f_{sw}=	50	kHz

Figure 20. for neutral point IGBT+ half bridge FWD

Typical available output current as a function of of phase displacement

I_{out}=f(φ) **T3+D5**

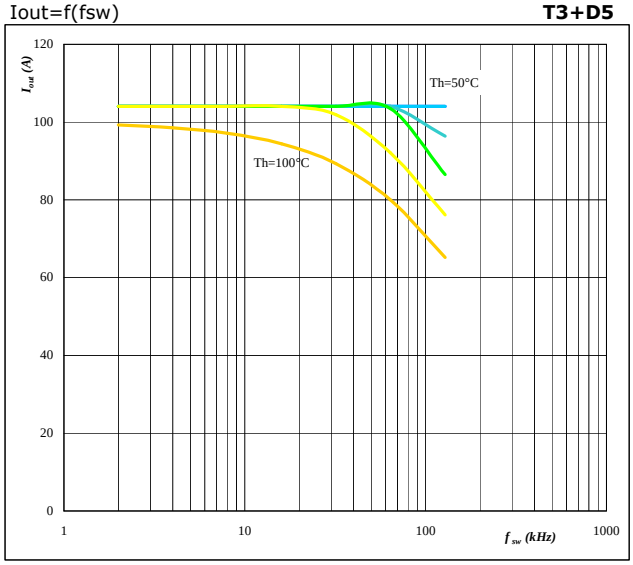


Conditions	T_j=	135	°C		f_{sw}=	50 kHz
	DC link=	700	V			
parameter:	Heatsink temp.					
	Th from	50	°C to	100		°C
	in	10	°C	steps		

Figure 21. for neutral point IGBT+ half bridge FWD

Typical available output current as a function of switching frequency

Iout=f(fsw) **T3+D5**

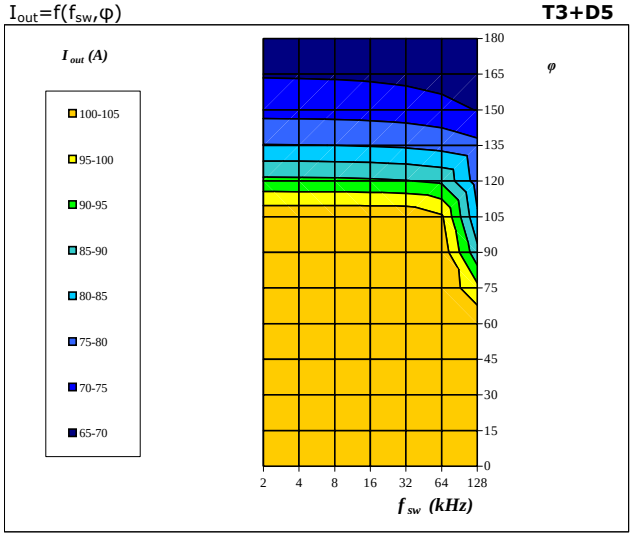


Conditions	T_j=	135	°C		φ=	90°
	DC link=	700	V			
parameter:	Heatsink temp.					
	Th from	50	°C to	100		°C
	in	10	°C	steps		

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},φ) **T3+D5**

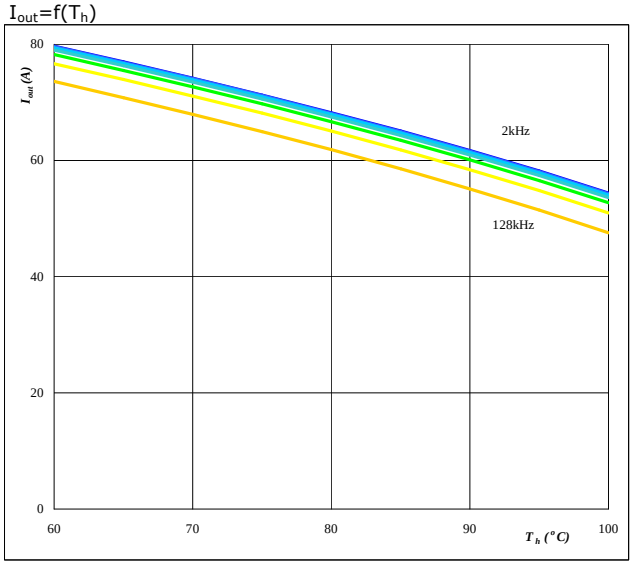


Conditions	T_j=	135	°C
	DC link=	700	V
	T_h=	80	°C

Figure 23. per PHASE

Typical available output current as a function of heat sink temperature

$I_{out}=f(T_h)$

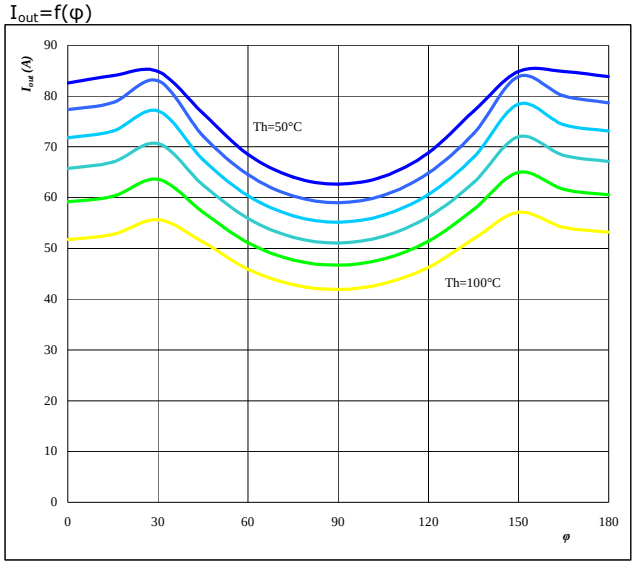


Conditions	T_j=	135	°C	
	DC link=	700	V	
	φ=	0 °		
parameter:	Switching freq.			
	fsw from	2	kHz to	128 kHz
	in steps of factor 2			

Figure 24. per PHASE

Typical available output current as a function of phase displacement

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

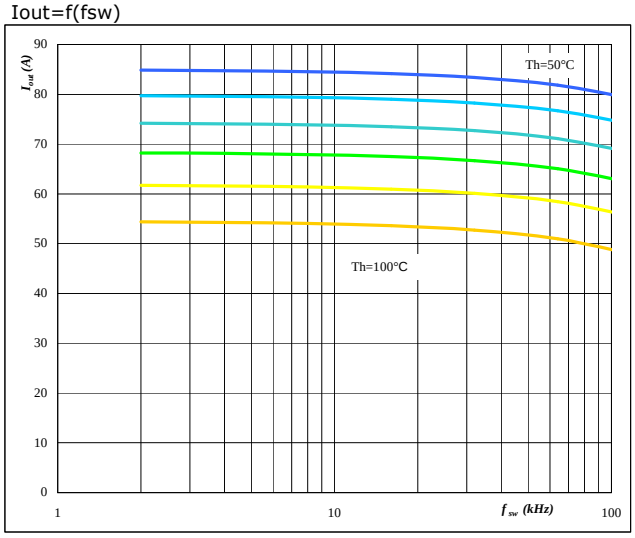


Conditions	T_j=	135	°C	
	DC link=	700	V	
	f_{sw}=	50	kHz	
parameter:	Heatsink temp.			
	Th from	50	°C to	100
	in	10	°C	steps

Figure 25. per PHASE

Typical available output current as a function of switching frequency

Iout=f(fsw)

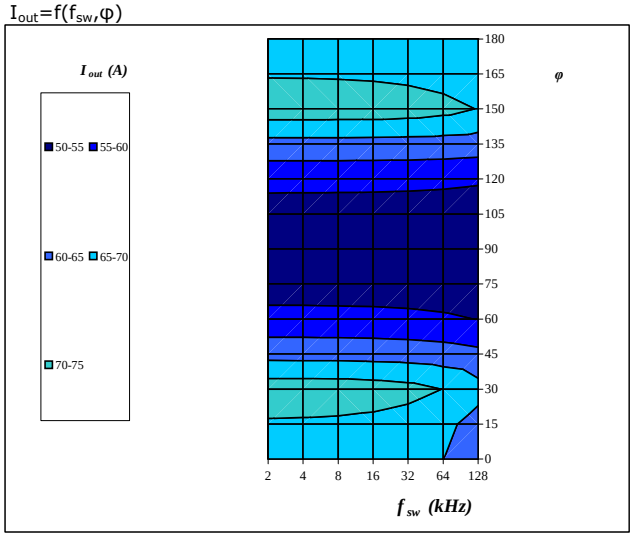


Conditions	T_j=	135	°C	φ=	0 °	
	DC link=	700	V			
parameter:	Heatsink temp.					
	Th from	50	°C to	100		
	in	10	°C	steps		

Figure 26. per PHASE

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

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

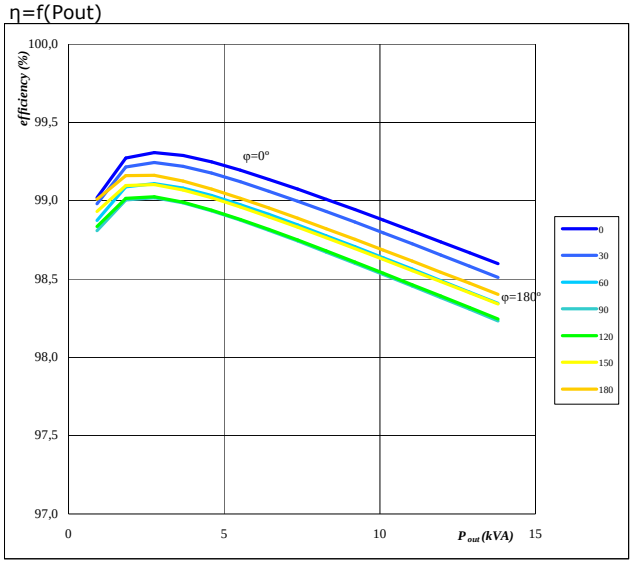


Conditions	T_j=	135	°C
	DC link=	700	V
	T_h=	80	°C

Figure 27. per PHASE

Typical efficiency as a function of output power

η=f(Pout)

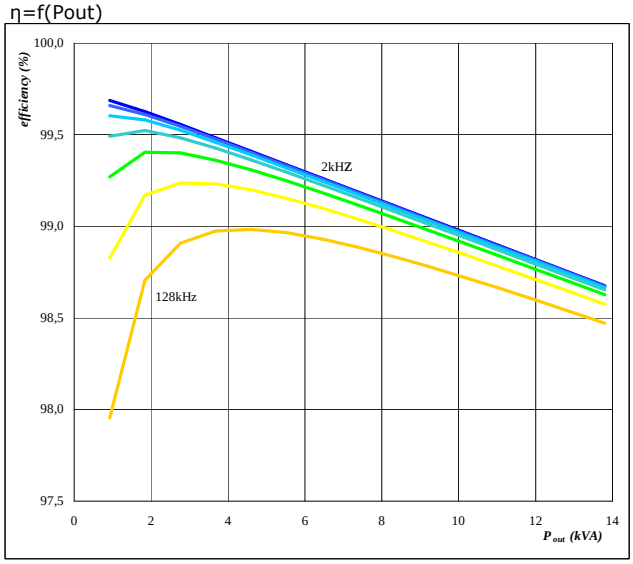


Conditions T_j= 125 °C
f_{sw}= 50 kHz
DC link= 700 V
parameter: phase displacement
φ from 0 ° to 180 °
in steps of 30 °

Figure 28. per PHASE

Typical efficiency as a function of output power

η=f(Pout)

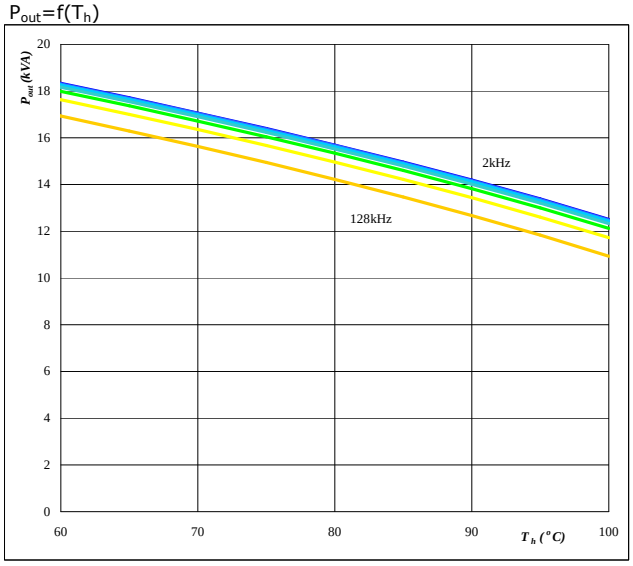


Conditions T_j= 125 °C φ= 0 °
DC link= 700 V
parameter: Switching freq.
fsw from 2 kHz to 128 kHz
in steps of factor 2

Figure 29. per PHASE

Typical available output power as a function of heat sink temperature

$P_{out}=f(T_h)$

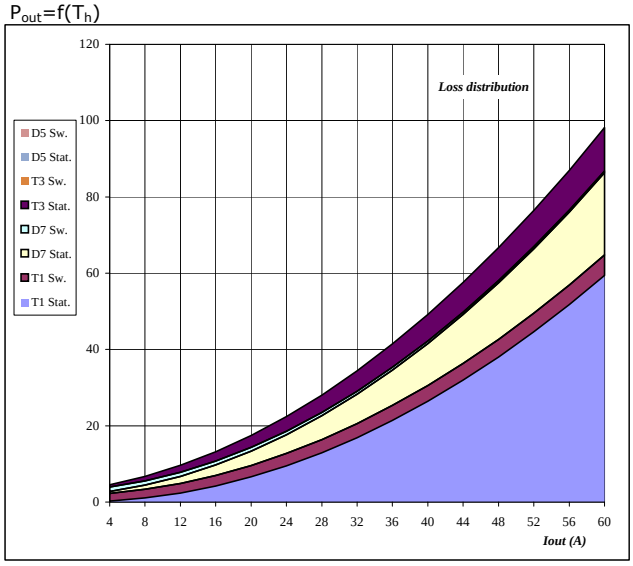


Conditions T_j= 125 °C
DC link= 700 V
φ= 0 °
parameter: Switching freq.
fsw from 2 kHz to 128 kHz
in steps of factor 2

Figure 30. per PHASE

Typical loss distribution as a function of output current

$P_{out}=f(T_h)$

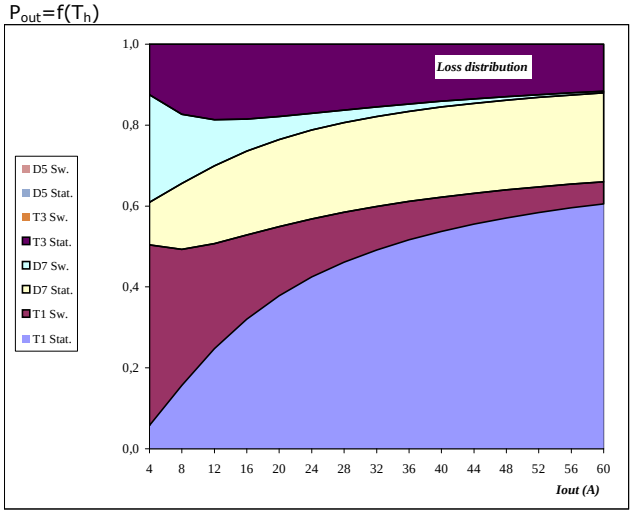


Conditions T_j= 125 °C
f_{sw}= 50 kHz
DC link= 700 V
φ= 0 °

Figure 31. per PHASE

Typical relativ loss distribution as a function of output current

$P_{out}=f(T_h)$



Conditions			
	T_j=	125	°C
	f_{sw}=	50	kHz
	DC link=	700	V
	φ=	0	°