flow MNPC 4w   1200 V / 600 A

Features

- Mixed voltage NPC
- Low inductive
- High power screw interface

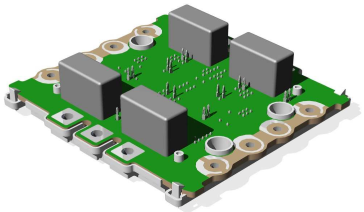
Target Applications

- Solar inverter
- UPS
- High speed motor drive

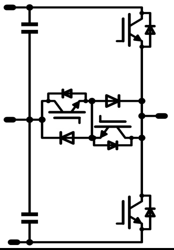
Types

- 70-W212NMC600SH01-M700P

flow SCREW 4w housing



Schematic



Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
half bridge IGBT (T1 , T4)					
Collector-emitter break down voltage	V_{CE}			1200	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	457 589	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max		1800	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	1105 1674	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 800	μs V
Turn off safe operating area (RBSOA)	I_{cmax}	$V_{CE\ max}$ = 1200V $T_{vj\ max}$= 150°C		1200	A
Maximum Junction Temperature	T_{jmax}			175	°C
neutral point FWD (D2 , D3)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	318 430	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms	T_{vj} < 150°C	1800	A
Power dissipation per FWD	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	389 589	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit

neutral point IGBT (T2 , T3)

Parameter	Symbol	Condition	Value	Unit
Collector-emitter break down voltage	V_{CE}		600	V
DC collector current	I_C	$T_j=T_j$max $T_h=80°C$ $T_c=80°C$	420 550	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_j$max	1800	A
Power dissipation	P_{tot}	$T_j=T_j$max $T_h=80°C$ $T_c=80°C$	645 977	W
Gate-emitter peak voltage	V_{GE}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j≤150°C$ $V_{GE}=15V$	6 360	μs V
Turn off safe operating area (RBSOA)	I_{cmax}	$V_{CE\ max}$ = 1200V $T_{vj\ max}$= 150°C	1200	A
Maximum Junction Temperature	T_{jmax}		175	°C

half bridge FWD (D1 , D4)

Parameter	Symbol	Condition	Value	Unit
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C	1200	V
DC forward current	I_F	$T_j=T_j$max $T_h=80°C$ $T_c=80°C$	239 316	A
Surge forward current	I_{FSM}	t_p=10ms , sin 180° $T_j=150°C$	1800	A
I2t-value	I^2t		8100	A^2s
Power dissipation per FWD	P_{tot}	$T_j=T_j$max $T_h=80°C$ $T_c=80°C$	468 709	W
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
DC link Capacitor				
Max.DC voltage	V_{MAX}	T_{cmax}=100°C	630	V
General Module Properties				
Material of module baseplate			Cu	
Material of internal isulation			Al2O3	
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+(Tjmax - 25)	°C
Insulation Properties				
Insulation voltage	V_{is}	t=2s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm
Comparative tracking index	CTI		>200	

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
half bridge IGBT (T1 , T4)										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0208	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	Tj=25°C Tj=150°C	1,4	2,22 2,75	2,4	V
Collector-emitter cut-off current incl. FWD	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,08	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			960	nA
Integrated Gate resistor	R_{gint}							1,25		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=0,5 Ω Rgon=0,5 Ω	±15	350	600	Tj=25°C Tj=125°C		245 256		ns
Rise time	t_r					Tj=25°C Tj=125°C		44 54		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		301 349		
Fall time	t_f					Tj=25°C Tj=125°C		34 57		
Turn-on energy loss	E_{on}					Tj=25°C Tj=125°C		10 18		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=125°C		14 24		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		35200		pF
Output capacitance	C_{oss}							2250		
Reverse transfer capacitance	C_{rss}							1880		
Gate charge	Q_G		15	960	600	Tj=25°C		2775		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,09		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,06		
neutral point FWD (D2 , D3)										
FWD forward voltage	V_F				600	Tj=25°C Tj=150°C	1,27	1,68 1,60	1,97	V
Peak reverse recovery current	I_{RRM}	Rgon=0,5 Ω	±15	350	600	Tj=25°C Tj=125°C		350 415		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		168 289		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		24 45		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=125°C		5978 3609		A/μs
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		5 10		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,24		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,16		
neutral point IGBT (T2 , T3)										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0096	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		600	Tj=25°C Tj=150°C	1,05	1,54 1,80	1,85	V
Collector-emitter cut-off incl FWD	I_{CES}		0	600		Tj=25°C Tj=150°C			0,0304	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			2400	nA
Integrated Gate resistor	R_{gint}							0,5		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=1 Ω Rgon=1 Ω	±15	350	600	Tj=25°C Tj=125°C		270 274		ns
Rise time	t_r					Tj=25°C Tj=125°C		41 45		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		351 374		
Fall time	t_f					Tj=25°C Tj=125°C		39 70		
Turn-on energy loss	E_{on}					Tj=25°C Tj=125°C		6 8		mWs
Turn-off energy loss	E_{off}					Tj=25°C Tj=125°C		17 23		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		36960		pF
Output capacitance	C_{oss}							2304		
Reverse transfer capacitance	C_{rss}							1096		
Gate charge	Q_G		15	480	600	Tj=25°C		3760		nC
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʎ=3,4W/mK						0,15		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,10		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
half bridge FWD (D1 , D4)										
FWD forward voltage	V_F				600	Tj=25°C Tj=150°C	1	2,15 2,15	2,7	V
Reverse leakage current	I_r			1200		Tj=25°C Tj=150°C			720	µA
Peak reverse recovery current	I_{RRM}	Rgon=1 Ω	±15	350	600	Tj=25°C Tj=125°C		477 599		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		67 91		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		19 33		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					Tj=25°C Tj=125°C		21481 20331		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=125°C		4 7		mWs
Thermal resistance chip to heatsink	$R_{th(j-s)}$	Phase-Change Material ʌ=3,4W/mK						0,20		K/W
Thermal resistance chip to case	$R_{th(j-c)}$							0,13		
DC link Capacitor										
C value	C							2* 0,68		µF
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R100=1486 Ω				Tc=100°C	-12		+14	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3996		K
Vincotech NTC Reference						Tj=25°C			B	
Module Properties										
Module inductance (from chips to PCB)	L_{sCE}							10		nH
Mounting torque	M	Screw M4 - mounting according to valid application note FSWB1-4TY-M-*-HI					2		2,2	Nm
Mounting torque	M	Screw M5 - mounting according to valid application note FSWB1-4TY-M-*-HI					4		6	Nm
Terminal connection torque	M	Screw M6 - mounting according to valid application note FSWB1-4TY-M-*-HI					2,5		5	Nm
Weight	G								1300	g

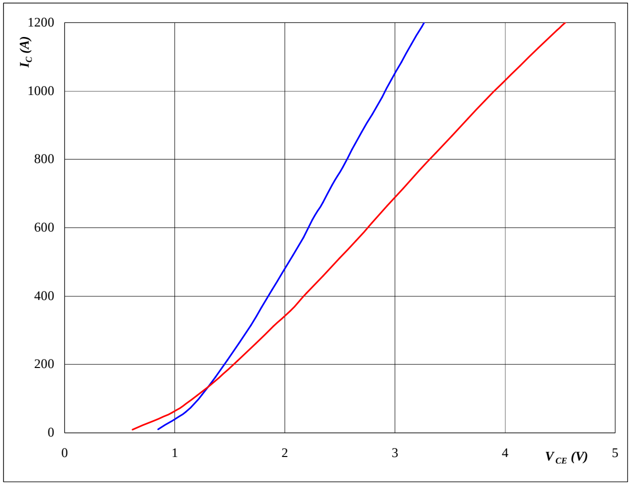
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 1 IGBT

Typical output characteristics Vge=15V

$I_C = f(V_{CE})$



At

t_p = 350 µs

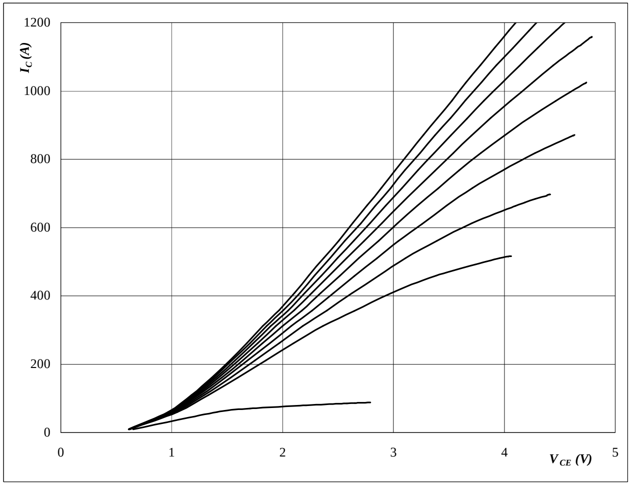
T_j = 25/125/150 °C

V_{GE}= 15 V

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

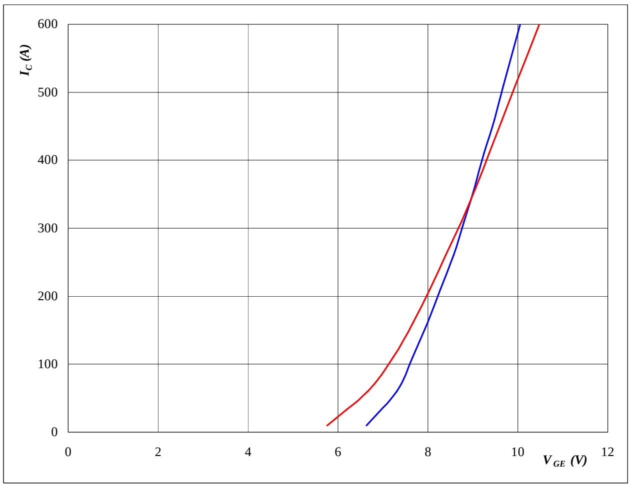
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

t_p = 350 µs

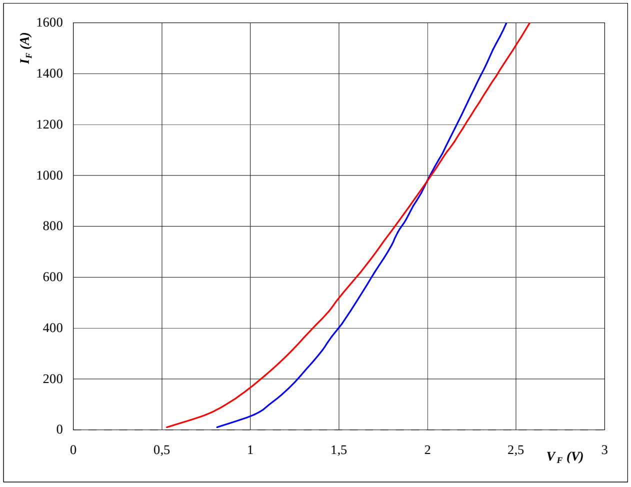
V_{CE} = 10 V

T_j= 25/125/150 °C

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

T_j= 25/125/150 °C

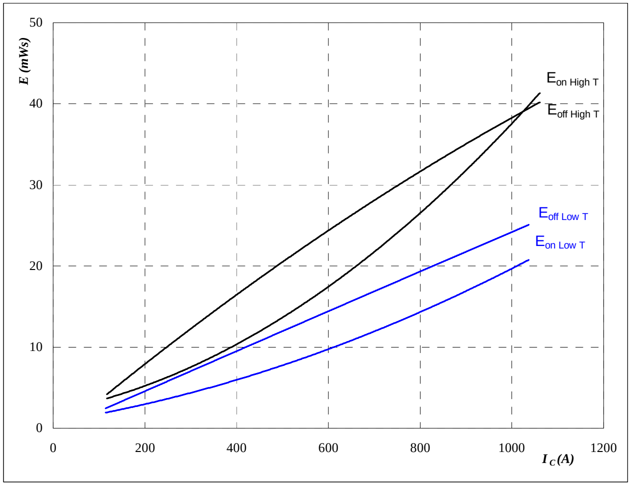
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 5 IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



With an inductive load at

T_j = 25/125/150 °C

V_{CE} = 350 V

V_{GE} = ±15 V

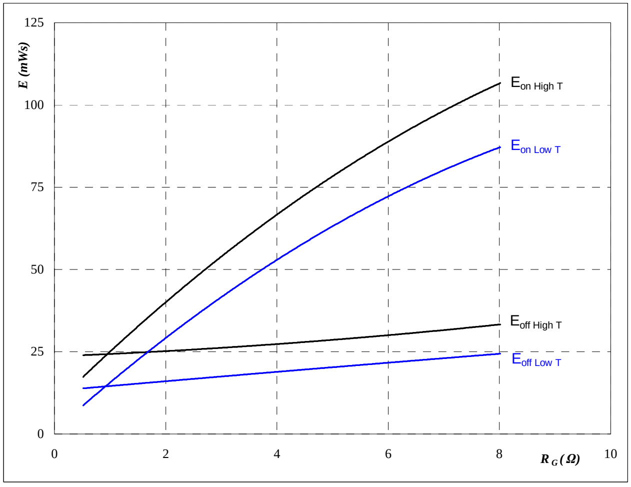
R_{gon} = 0,5 Ω

R_{goff} = 0,5 Ω

Figure 6 IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



With an inductive load at

T_j = 25/125/150 °C

V_{CE} = 350 V

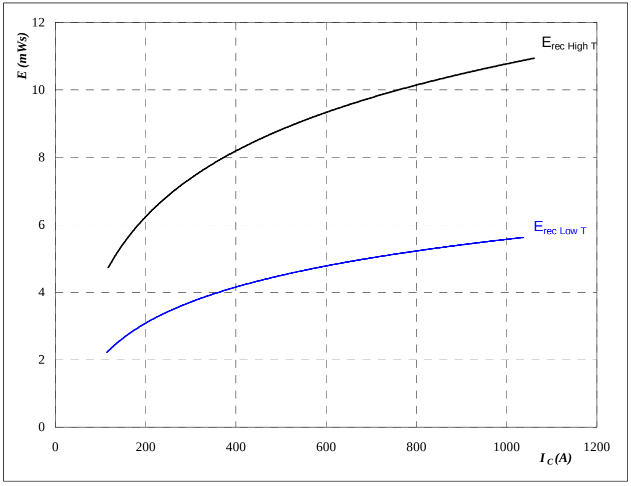
V_{GE} = ±15 V

I_C = 600 A

Figure 7 FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



With an inductive load at

T_j = 25/125/150 °C

V_{CE} = 350 V

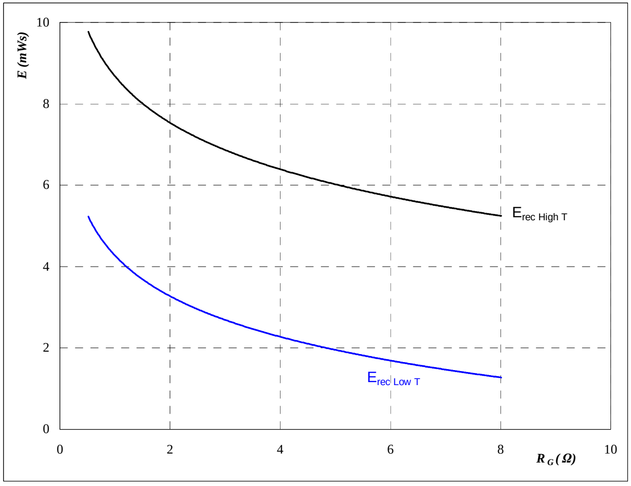
V_{GE} = ±15 V

R_{gon} = 0,5 Ω

Figure 8 FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

T_j = 25/125/150 °C

V_{CE} = 350 V

V_{GE} = ±15 V

I_C = 600 A

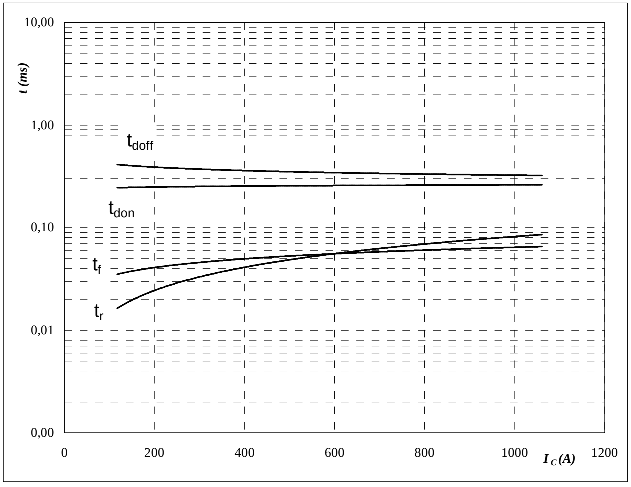
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



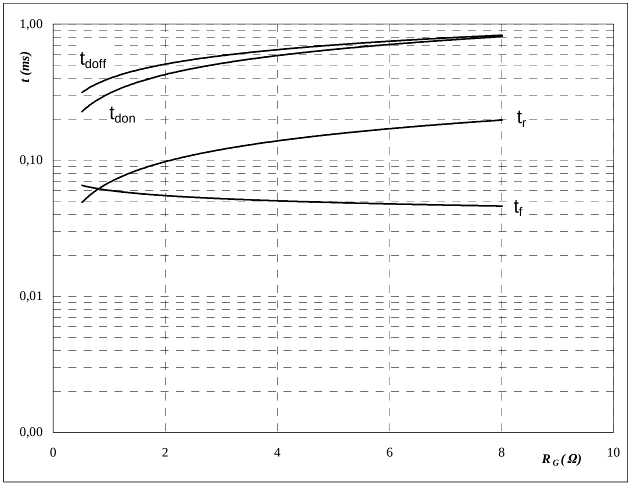
With an inductive load at

T_j = 125 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 0,5 Ω
R_{goff} = 0,5 Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



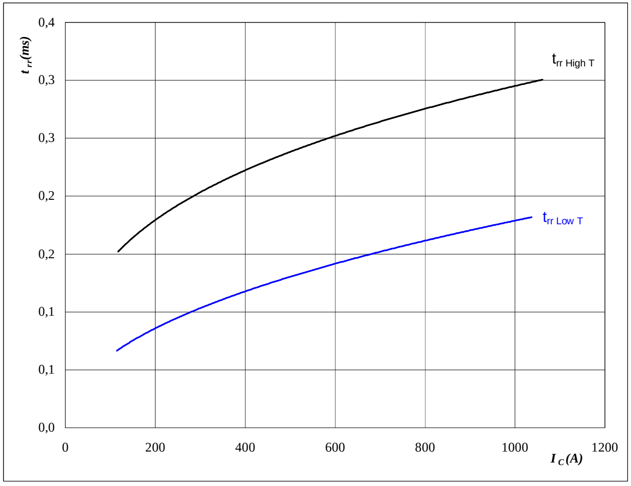
With an inductive load at

T_j = 125 °C
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 600 A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



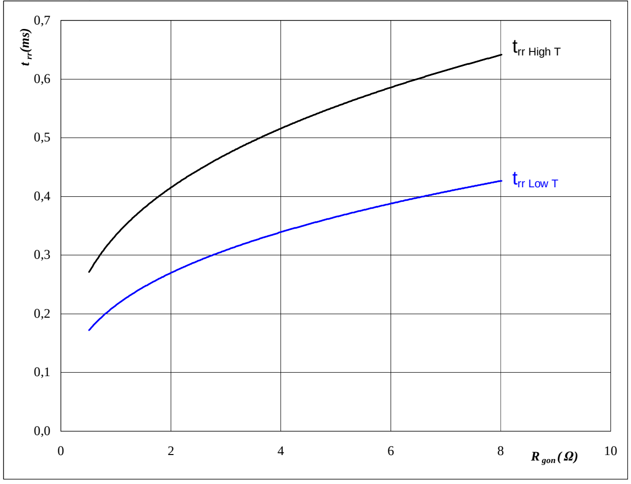
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 0,5 Ω

Figure 12 FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

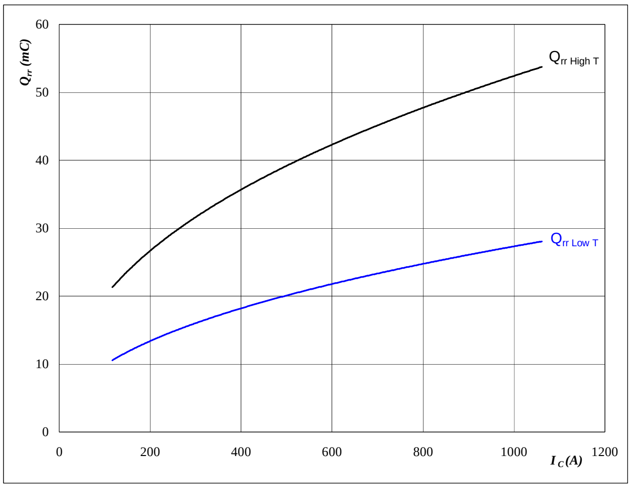
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



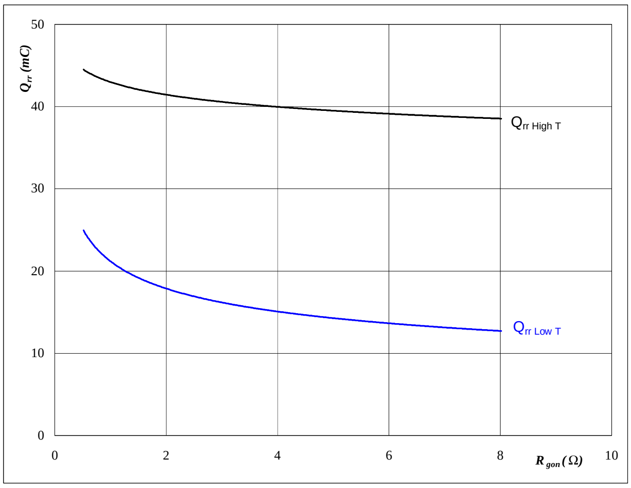
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 0,5 Ω

Figure 14 FWD

Typical reverse recovery charge as a function of IGBT turn on gate resistor

$Q_{rr} = f(R_{gon})$



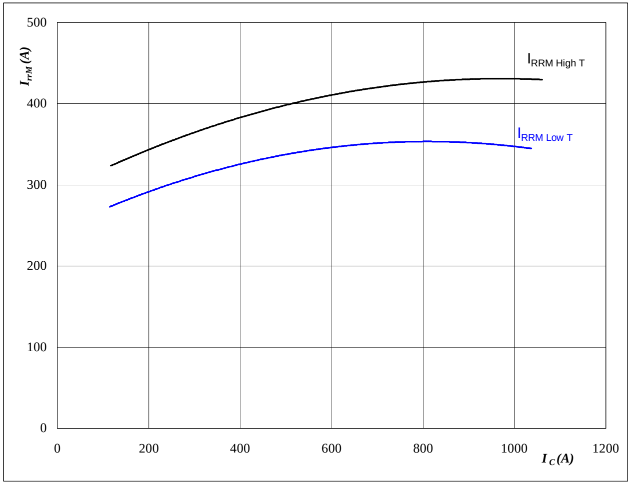
At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



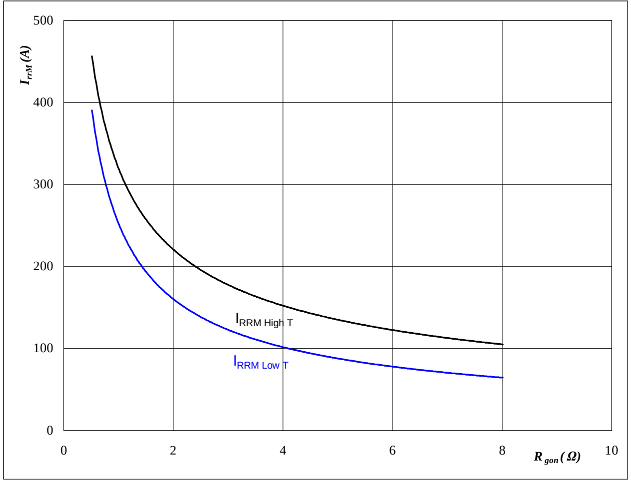
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 0,5 Ω

Figure 16 FWD

Typical reverse recovery current as a function of IGBT turn on gate resistor

$I_{RRM} = f(R_{gon})$



At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

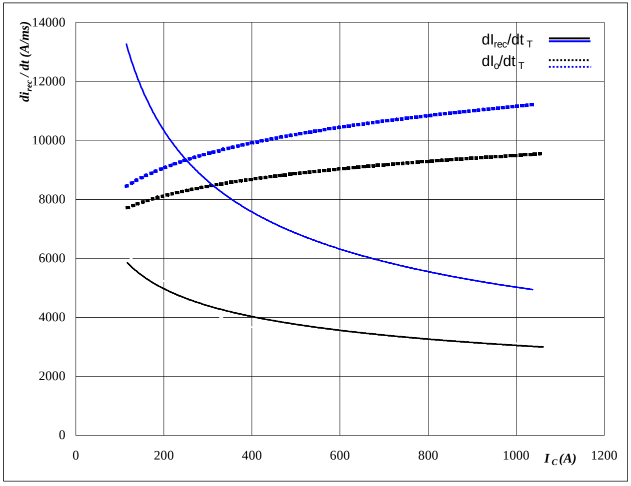
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 17 FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current

$dI_0/dt, dI_{rec}/dt = f(I_c)$



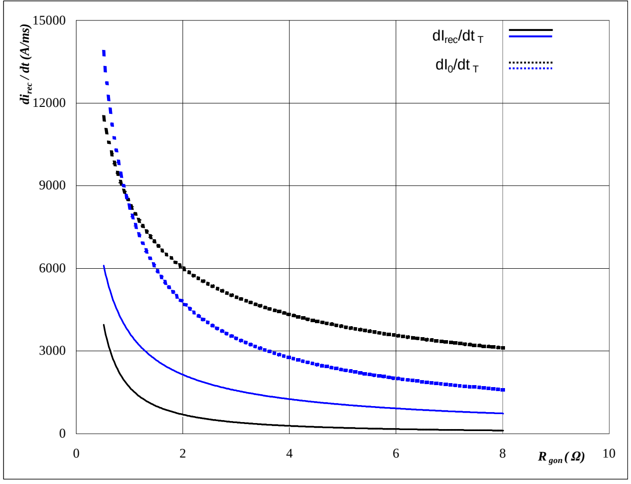
At

T_j = 25/125 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 0,5 Ω

Figure 18 FWD

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



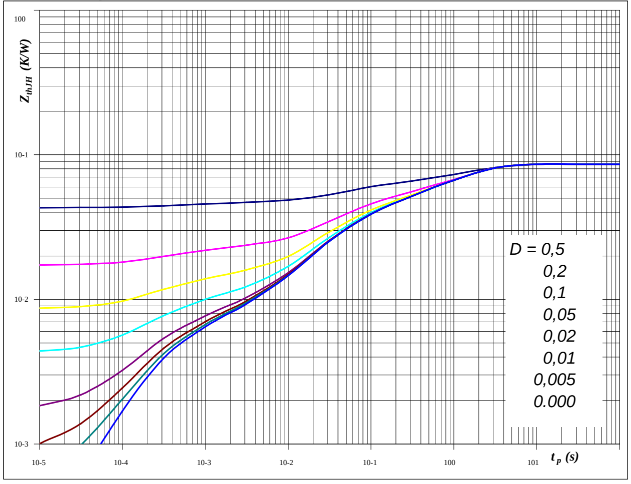
At

T_j = 25/125 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

Figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T
R_{thJH} = 0,086 K/W

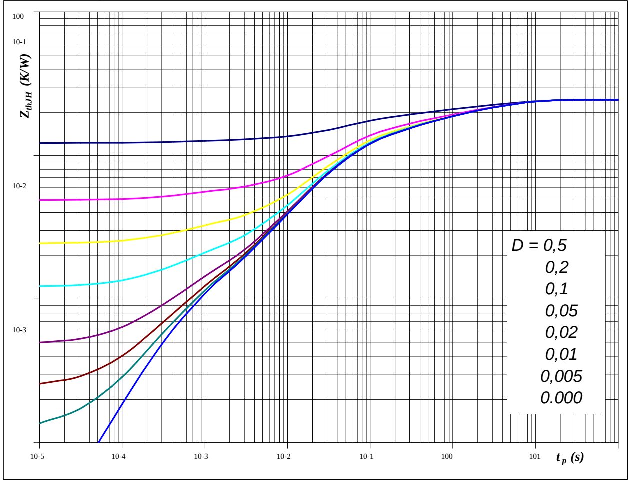
IGBT thermal model values

R (K/W)	Tau (s)
0,037	1,555
0,019	0,210
0,023	0,031
0,003	0,002
0,005	0,0003

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T
R_{thJH} = 0,244 K/W

FWD thermal model values

R (K/W)	Tau (s)
0,046	5,114
0,048	1,051
0,046	0,196
0,074	0,043
0,018	0,014

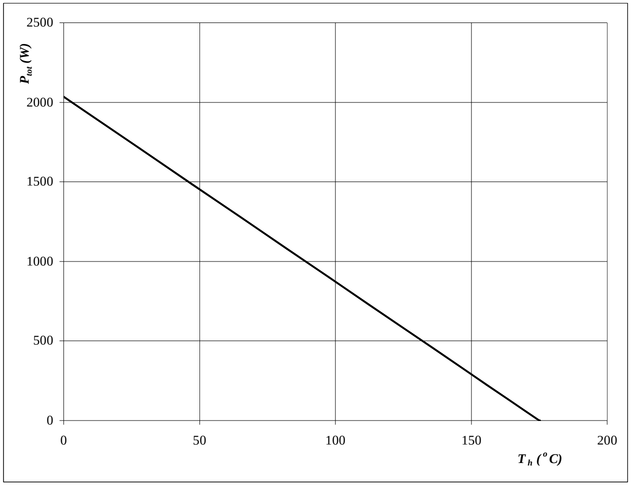
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



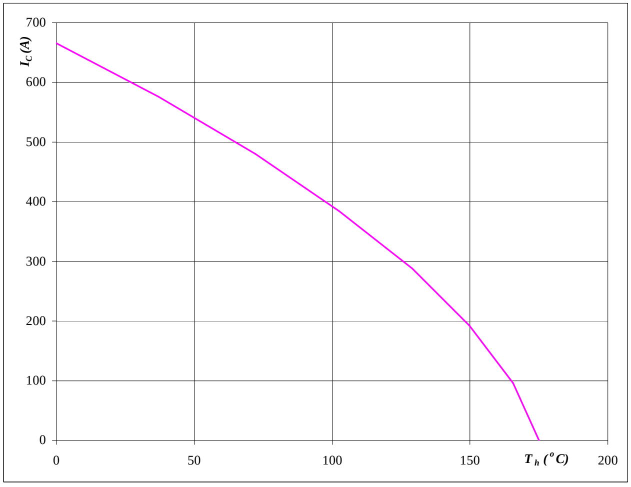
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

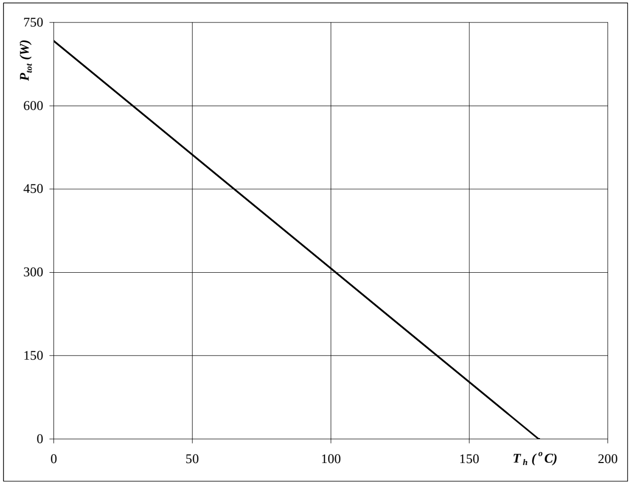
T_j = 175 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



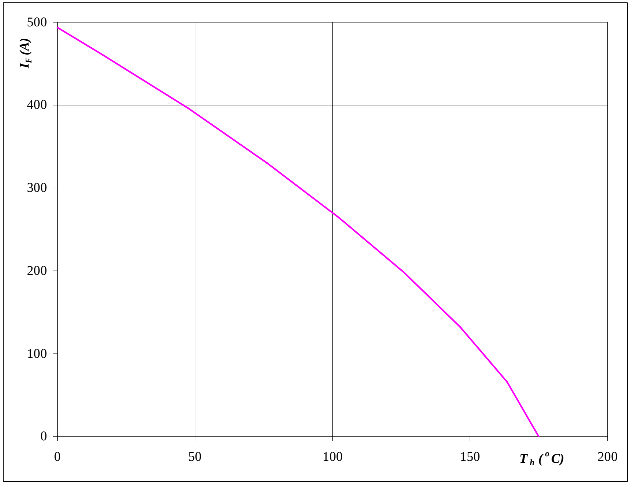
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 175 °C

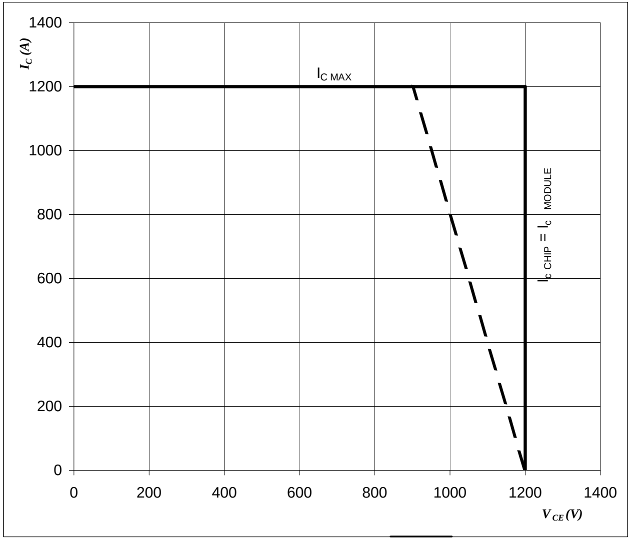
Buck operation

half bridge IGBT (T1,T4) and neutral point FWD (D2,D3)

Figure 25 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = 150 ºC

$U_{ccminus}=U_{ccplus}=U_{cc}/2$

V_{GE} = ±15 V

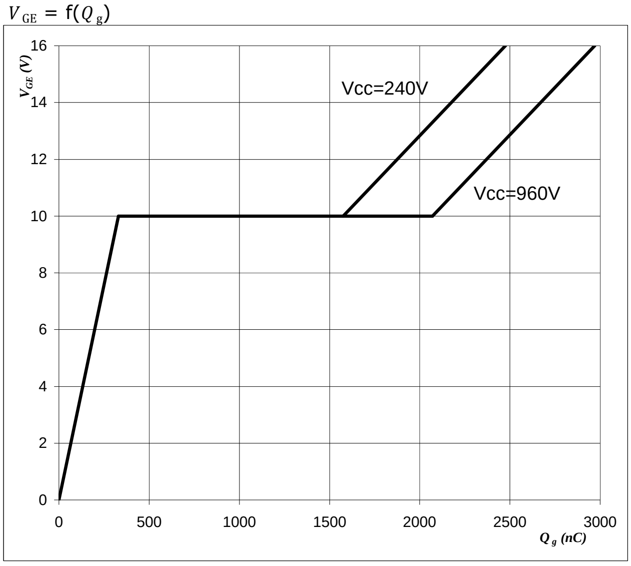
R_{gon} = 0,5 Ω

Switching mode: 3 level

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



At

I_C = 600 A

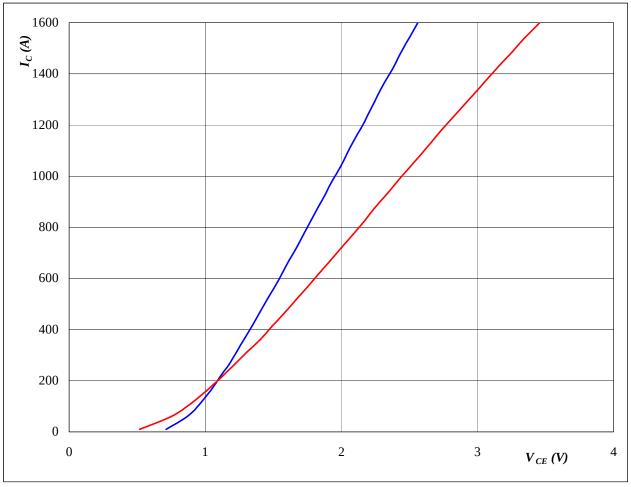
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 1 IGBT

Typical output characteristics Vge=15V

$I_C = f(V_{CE})$



At

t_p = 350 µs

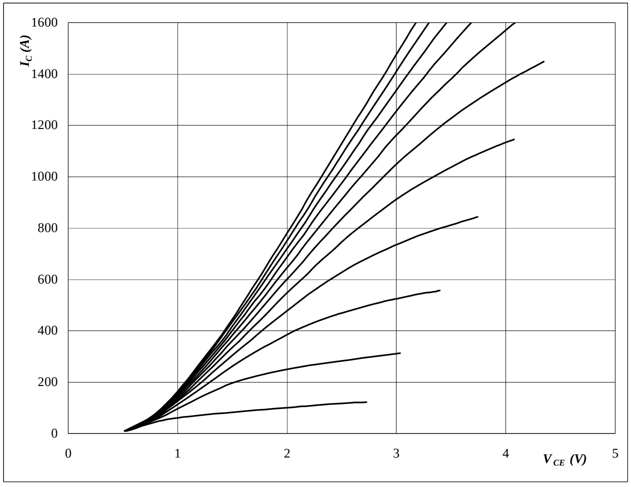
T_j = 25/125/150 °C

V_{GE}= 15 V

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 350 µs

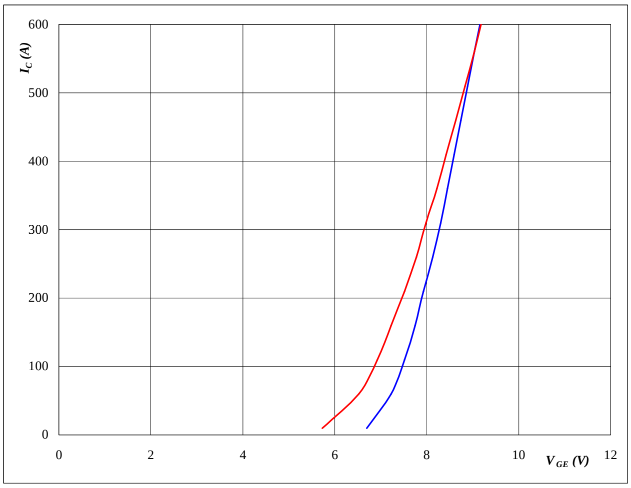
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



At

t_p = 350 µs

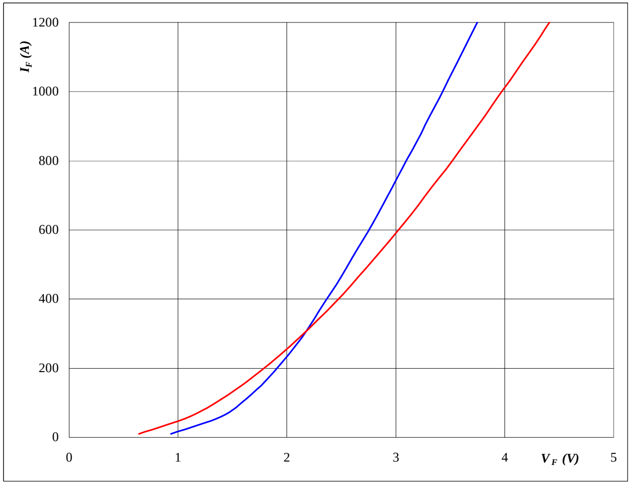
V_{CE} = 10 V

T_j = 25/125/150 °C

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 350 µs

T_j = 25/125/150 °C

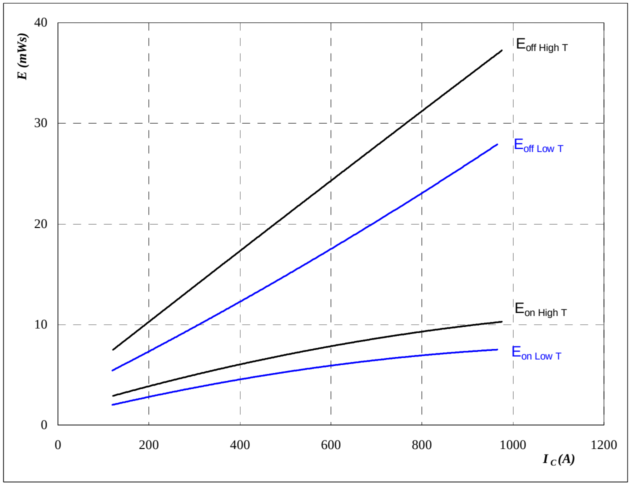
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



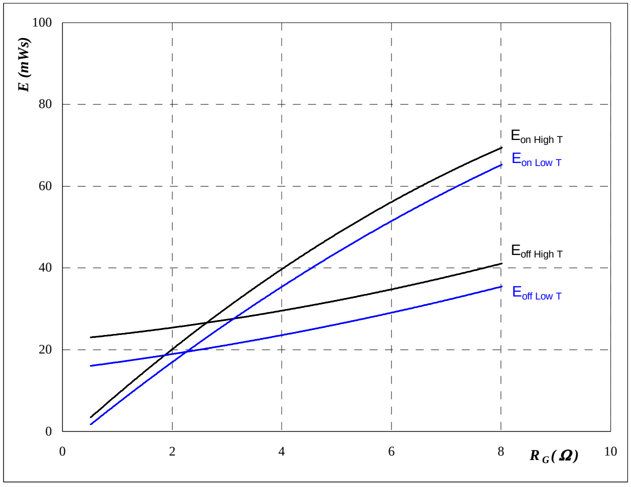
With an inductive load at

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω
R_{goff} = 1 Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



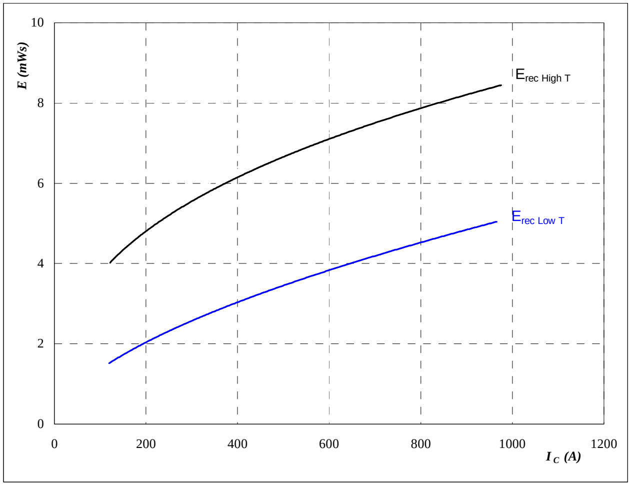
With an inductive load at

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 600 A

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



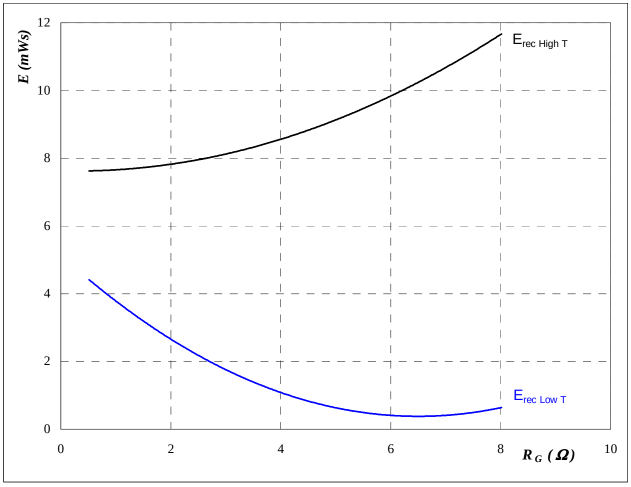
With an inductive load at

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω

Figure 8 FWD

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 600 A

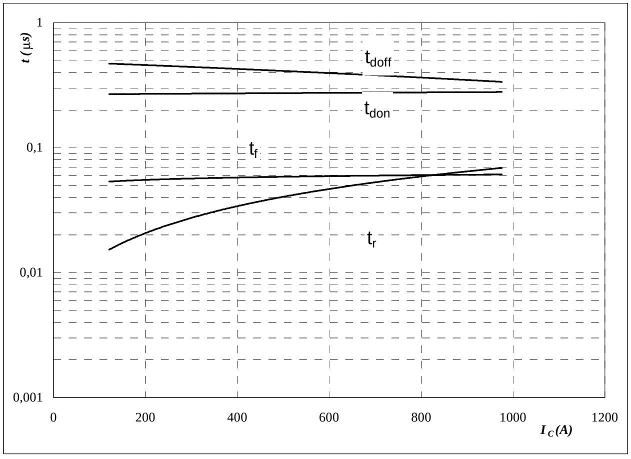
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



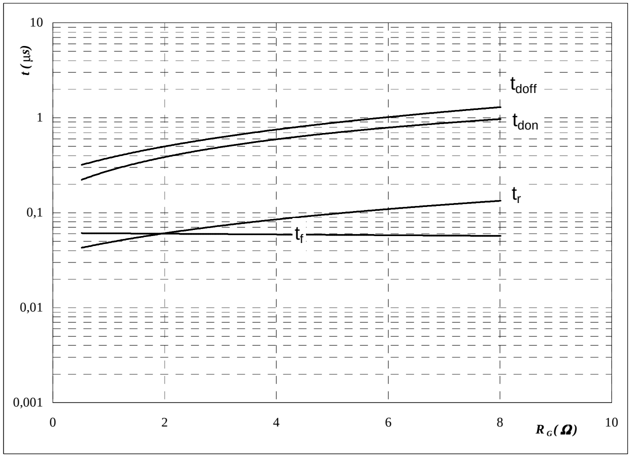
With an inductive load at

T_j = 125 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω
R_{goff} = 1 Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



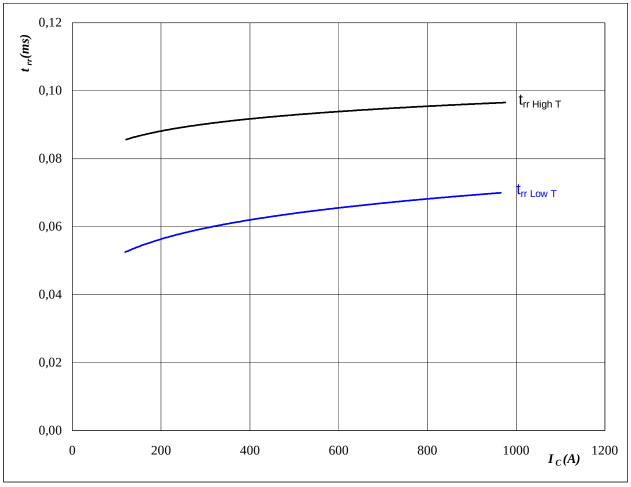
With an inductive load at

T_j = 125 °C
V_{CE} = 350 V
V_{GE} = ±15 V
I_C = 600 A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



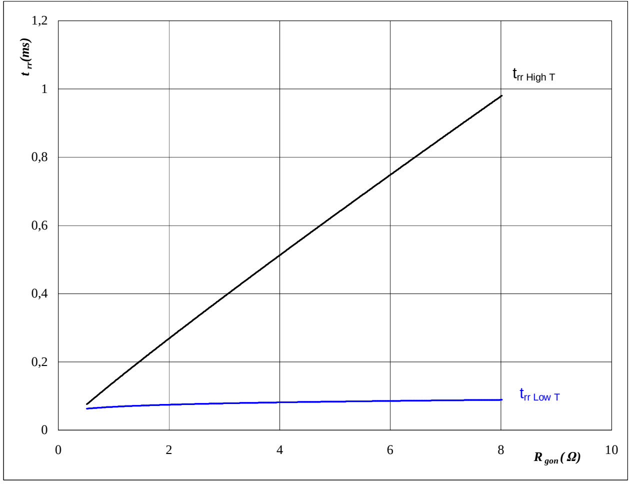
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω

Figure 12 FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

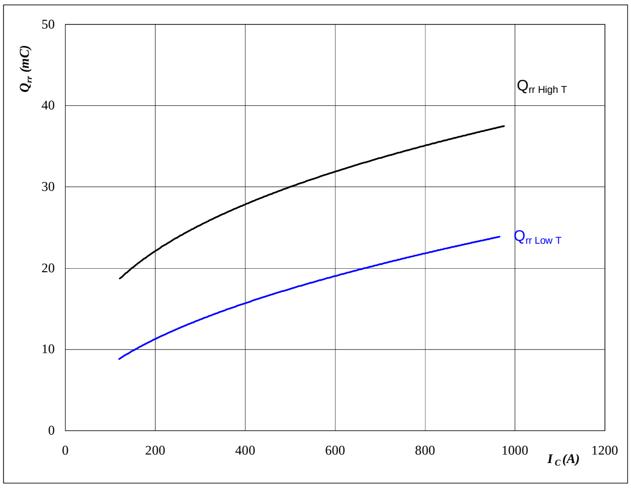
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



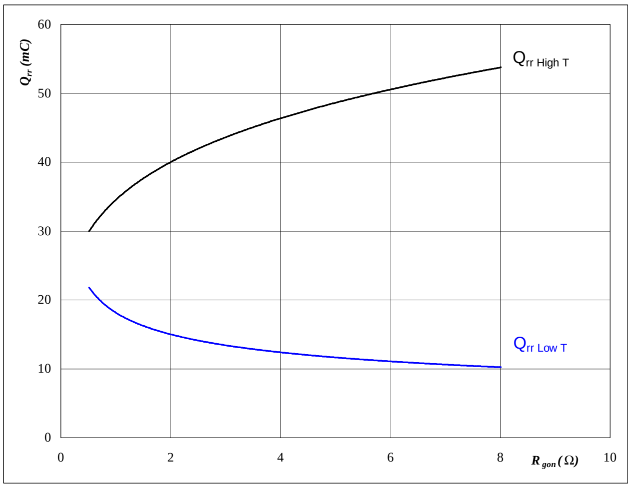
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω

Figure 14 FWD

Typical reverse recovery charge as a function of IGBT turn on gate resistor

$Q_{rr} = f(R_{gon})$



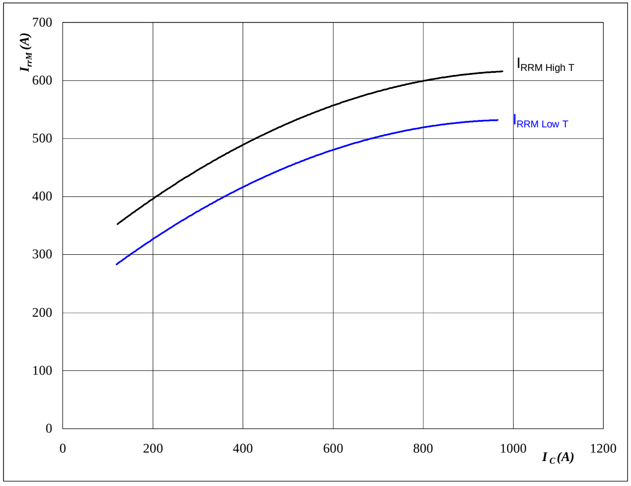
At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



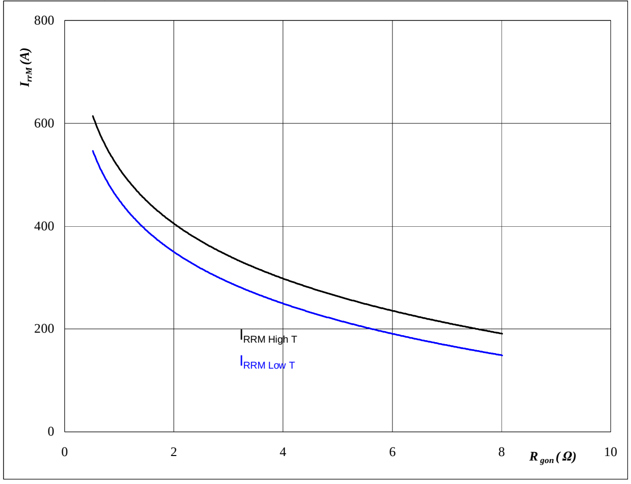
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω

Figure 16 FWD

Typical reverse recovery current as a function of IGBT turn on gate resistor

$I_{RRM} = f(R_{gon})$



At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

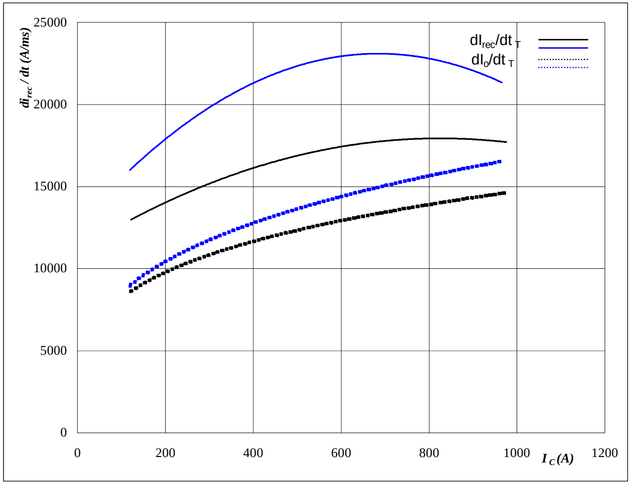
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 17 FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current

$dI_0/dt, dI_{rec}/dt = f(I_c)$



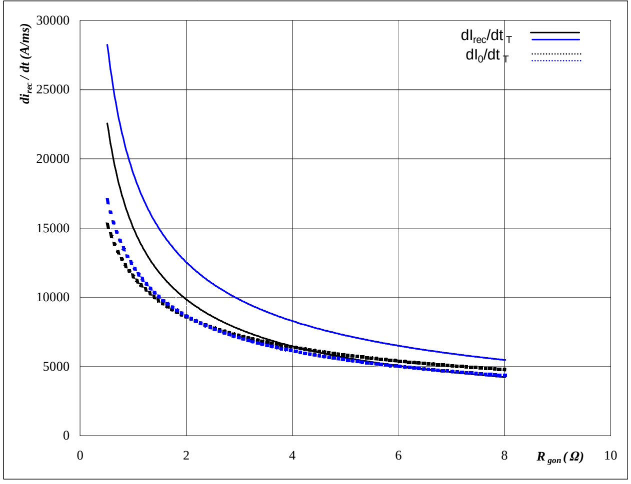
At

T_j = 25/125/150 °C
V_{CE} = 350 V
V_{GE} = ±15 V
R_{gon} = 1 Ω

Figure 18 FWD

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



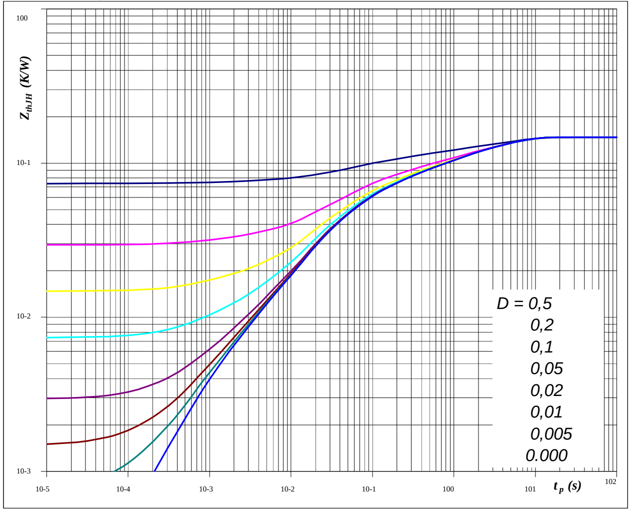
At

T_j = 25/125/150 °C
V_R = 350 V
I_F = 600 A
V_{GE} = ±15 V

Figure 19 IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

$D = t_p / T$
R_{thJH} = 0,15 K/W

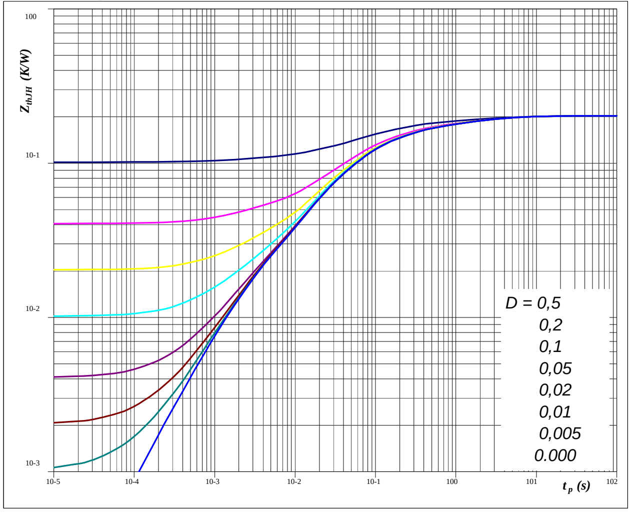
IGBT thermal model values

R (K/W)	Tau (s)
0,05	3,58
0,02	0,74
0,03	0,18
0,03	0,04
0,01	0,01

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

$D = t_p / T$
R_{thJH} = 0,20 K/W

FWD thermal model values

R (K/W)	Tau (s)
0,02	4,55
0,03	0,92
0,05	0,19
0,07	0,05
0,03	0,02

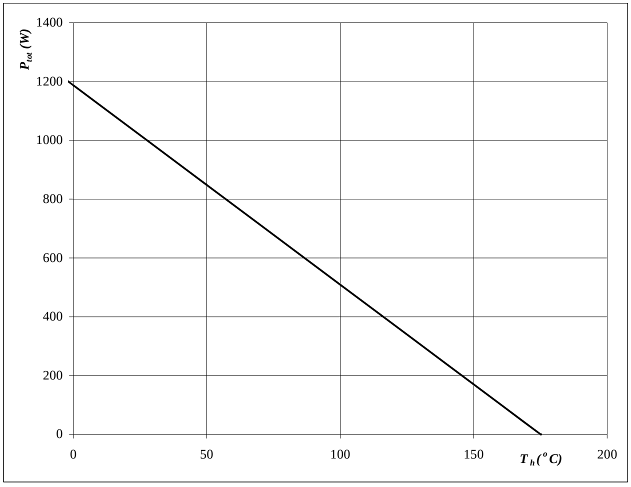
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



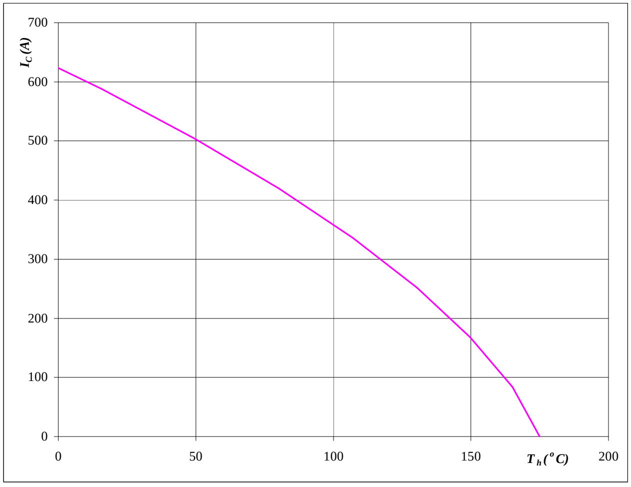
At

T_j = 175 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

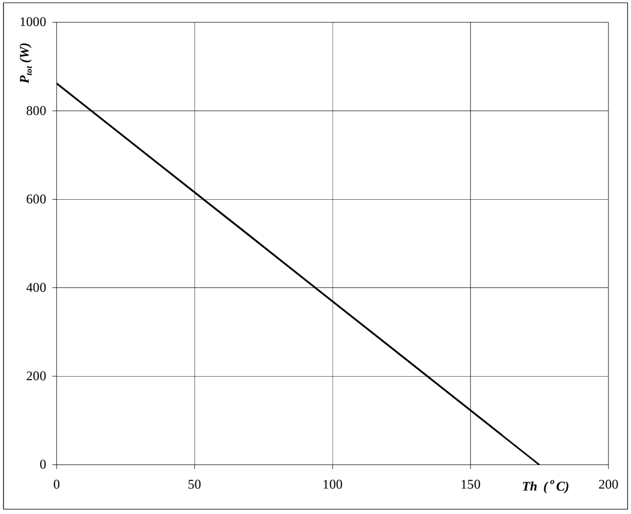
T_j = 175 ºC

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



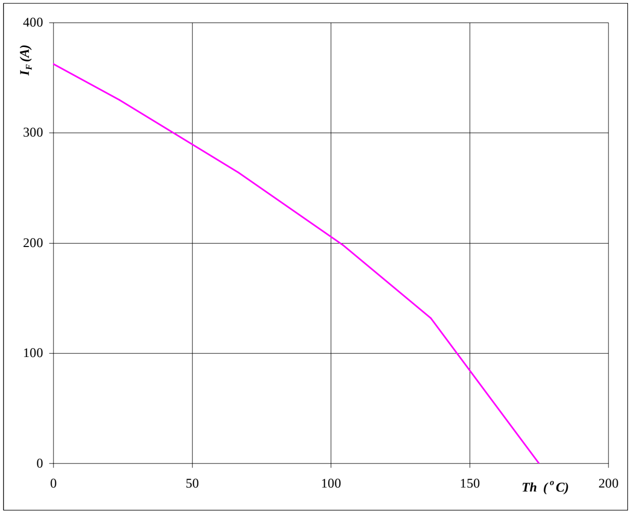
At

T_j = 175 ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 175 ºC

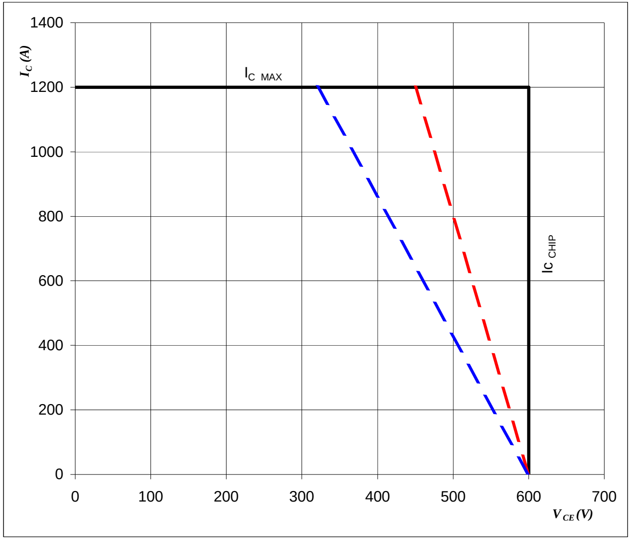
Boost operation

neutral point IGBT (T2,T3) and half bridge FWD (D1,D2)

Figure 25 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = 25,150 ºC

$U_{ccminus}$=U_{ccplus}=Uc_c/2

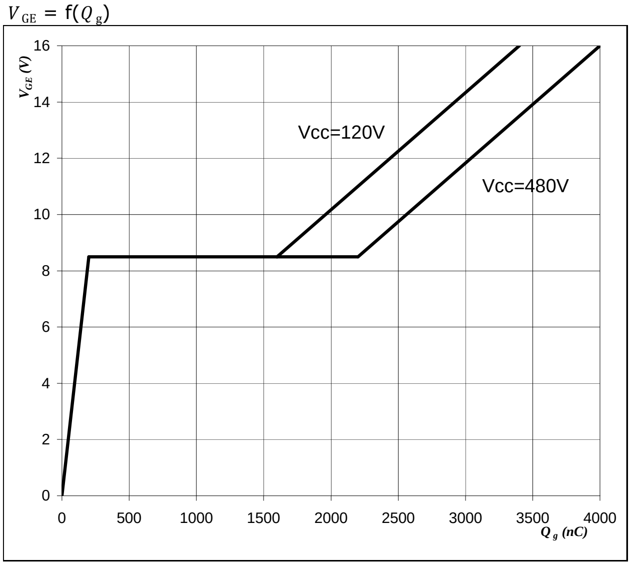
VGE = ±15 V

Rgon = 1 Ω

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



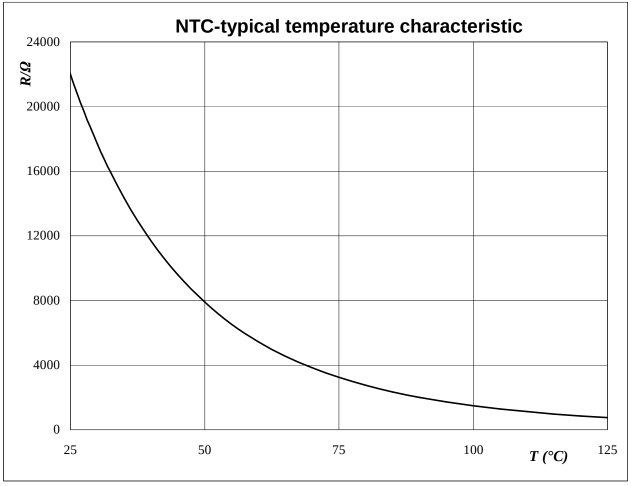
At

I_C = 600 A

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$



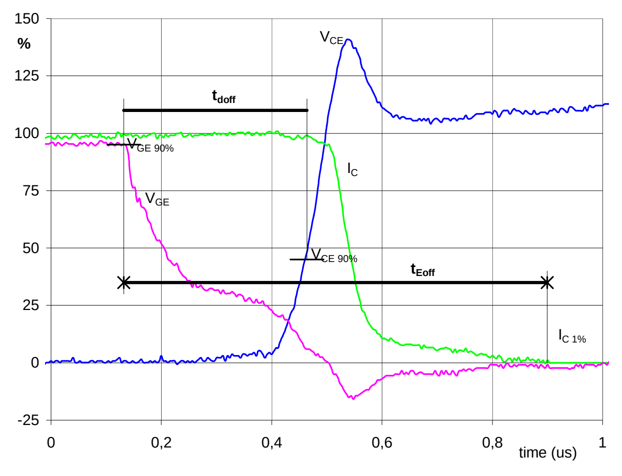
Switching Definitions Half Bridge

General conditions

T_j = 125 °C
R_{gon} = 0,5 Ω
R_{goff} = 0,5 Ω

Figure 1 Half Bridge IGBT

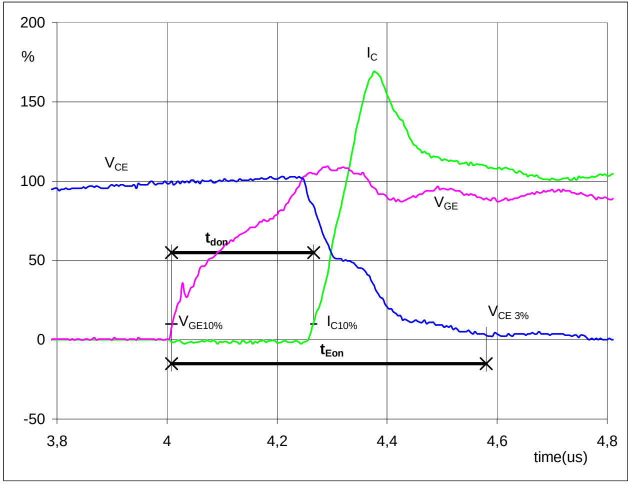
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_C (100%) = 700 V
I_C (100%) = 594 A
t_{doff} = 0,349 µs
$t_{E\,off}$ = 0,767 µs

Figure 2 Half Bridge IGBT

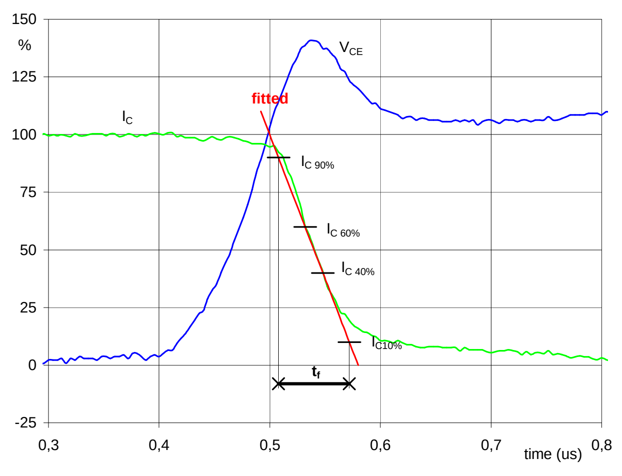
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_C (100%) = 700 V
I_C (100%) = 594 A
t_{don} = 0,256 µs
$t_{E\,on}$ = 0,572 µs

Figure 3 Half Bridge IGBT

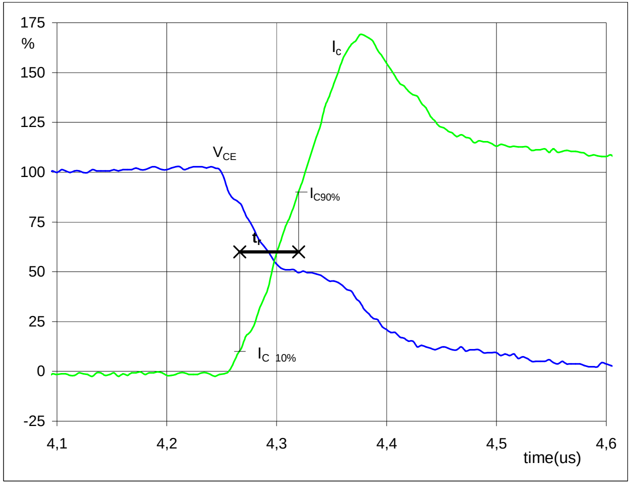
Turn-off Switching Waveforms & definition of t_f



V_C (100%) = 700 V
I_C (100%) = 594 A
t_f = 0,057 µs

Figure 4 Half Bridge IGBT

Turn-on Switching Waveforms & definition of t_r

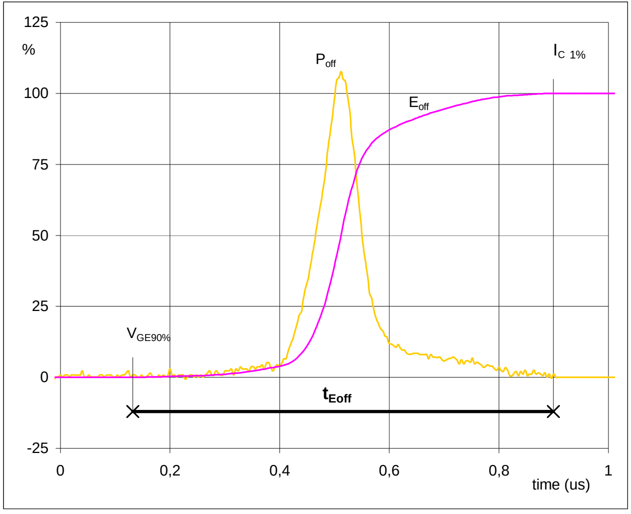


V_C (100%) = 700 V
I_C (100%) = 594 A
t_r = 0,054 µs

Switching Definitions Half Bridge

Figure 5 Half Bridge IGBT

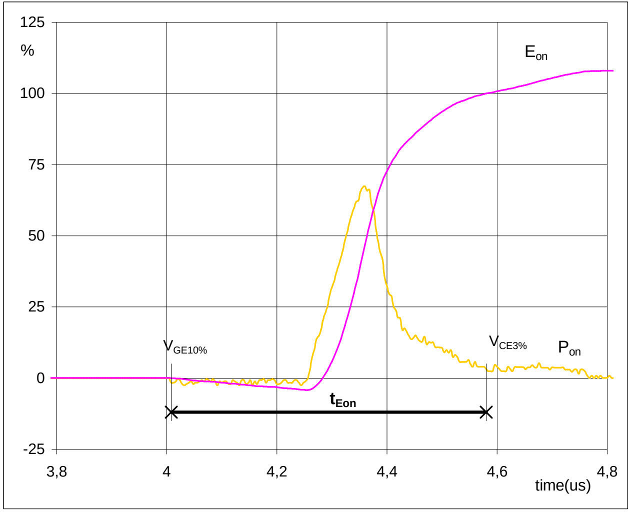
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 415,88 kW
E_{off} (100%) = 24,11 mJ
$t_{E\ off}$ = 0,767 µs

Figure 6 Half Bridge IGBT

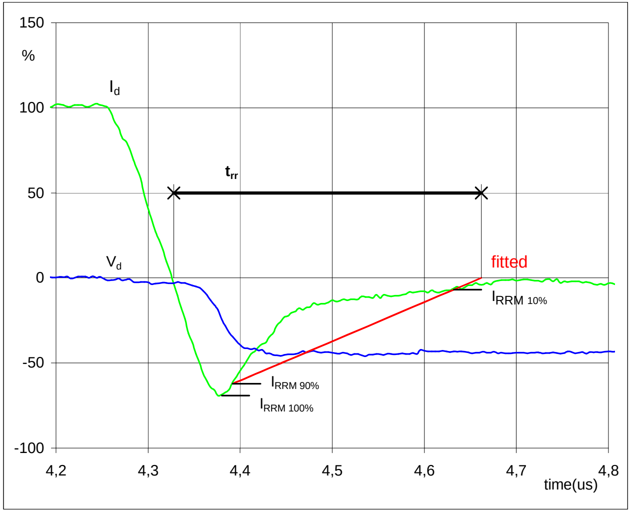
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 415,88 kW
E_{on} (100%) = 17,53 mJ
$t_{E\ on}$ = 0,572 µs

Figure 7 Neutral Point FWD

Turn-off Switching Waveforms & definition of t_{rr}

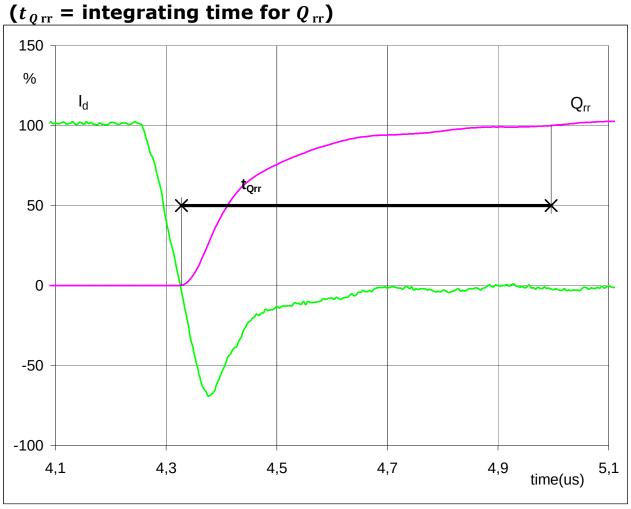


V_d (100%) = 700 V
I_d (100%) = 594 A
I_{RRM} (100%) = -415 A
t_{rr} = 0,289 µs

Switching Definitions Half Bridge

Figure 8 Neutral Point FWD

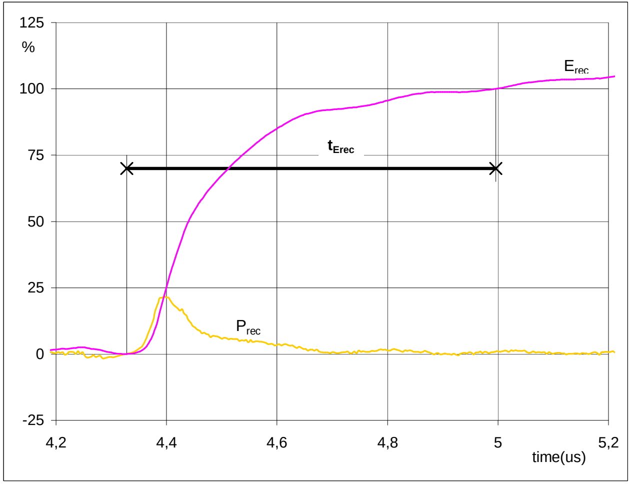
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	594	A
Q_{rr} (100%) =	45,49	μC
$t_{Q\,rr}$ =	0,67	μs

Figure 9 Neutral Point FWD

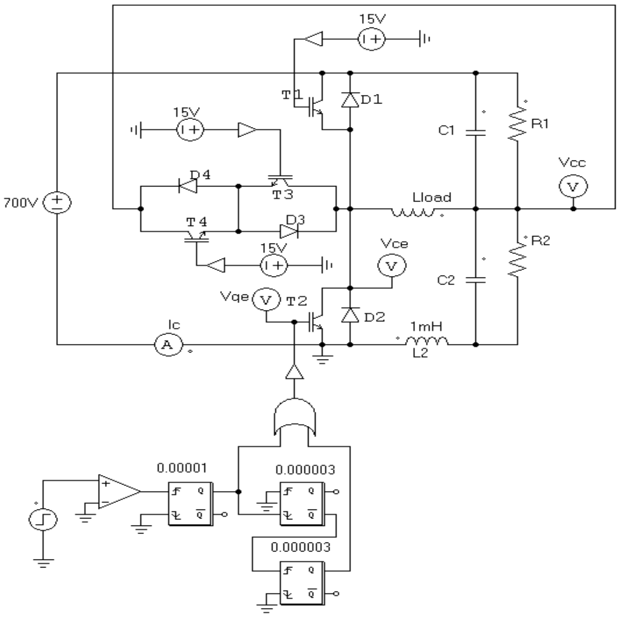
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	415,88	kW
E_{rec} (100%) =	10,16	mJ
$t_{E\,rec}$ =	0,67	μs

Half Bridge switching measurement circuit

Figure 10



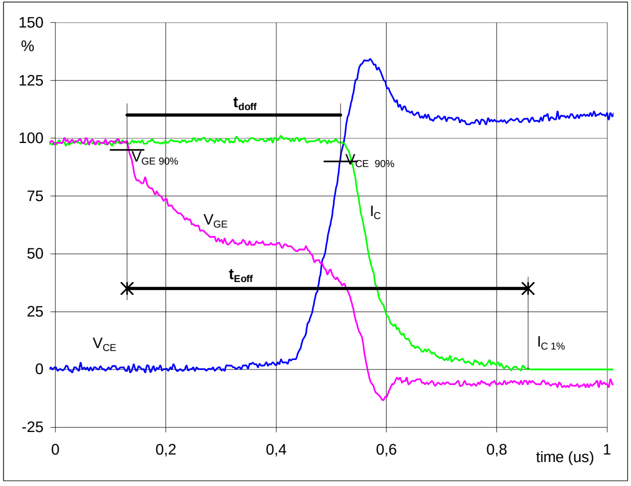
Switching Definitions Neutral Point

General conditions

T_j = 125 °C
R_{gon} = 1 Ω
R_{goff} = 1 Ω

Figure 1 Neutral Point IGBT

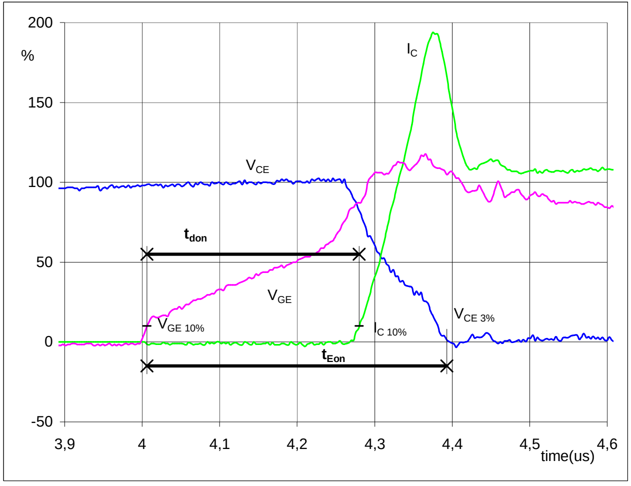
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_{C} (100%) = 350 V
I_{C} (100%) = 583 A
t_{doff} = 0,23 μs
$t_{E\,off}$ = 0,58 μs

Figure 2 Neutral Point IGBT

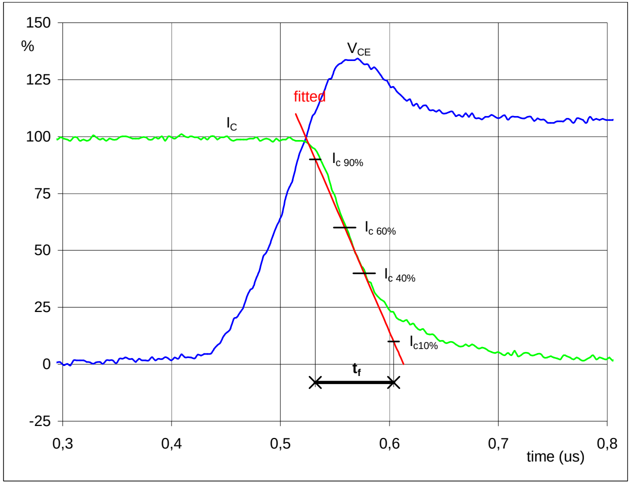
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) = -15 V
V_{GE} (100%) = 15 V
V_{C} (100%) = 350 V
I_{C} (100%) = 583 A
t_{don} = 0,274 μs
$t_{E\,on}$ = 0,38 μs

Figure 3 Neutral Point IGBT

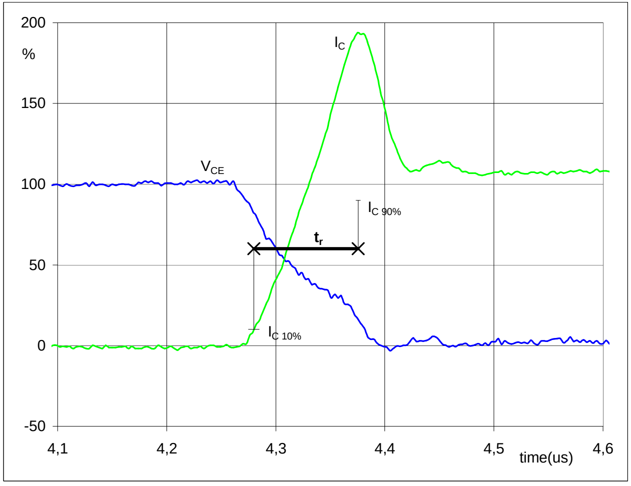
Turn-off Switching Waveforms & definition of t_f



V_{C} (100%) = 350 V
I_{C} (100%) = 583 A
t_f = 0,07 μs

Figure 4 Neutral Point IGBT

Turn-on Switching Waveforms & definition of t_r

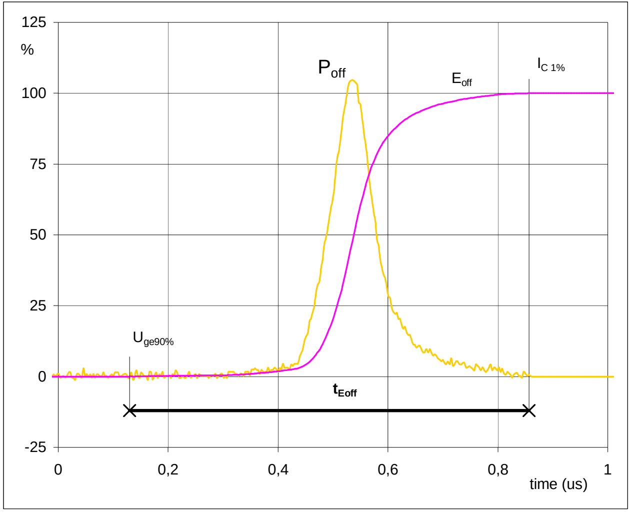


V_{C} (100%) = 350 V
I_{C} (100%) = 583 A
t_r = 0,045 μs

Switching Definitions Neutral Point

Figure 5 Neutral Point IGBT

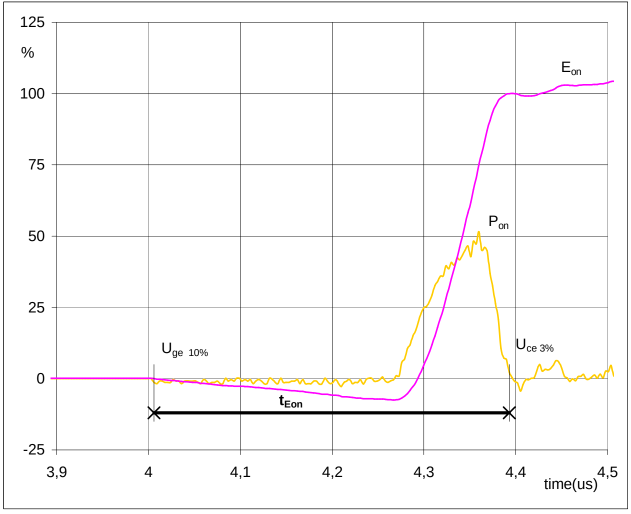
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	203,90	kW
E_{off} (100%) =	23,39	mJ
$t_{E\ off}$ =	0,58	μs

Figure 6 Neutral Point IGBT

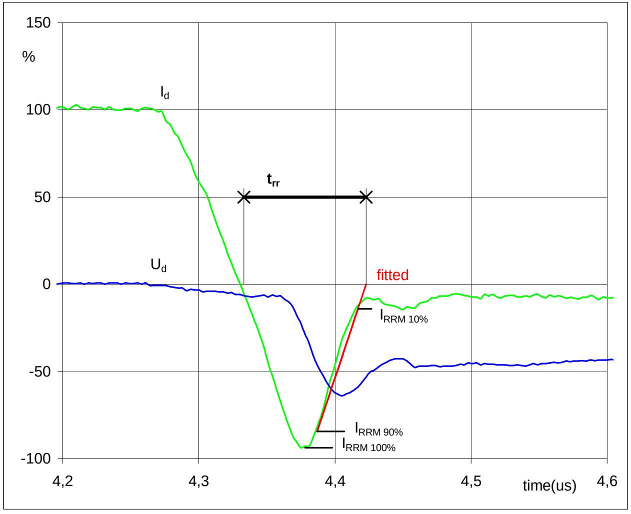
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	203,8995	kW
E_{on} (100%) =	13,39	mJ
$t_{E\ on}$ =	0,38	μs

Figure 7 Half Bridge FWD

Turn-off Switching Waveforms & definition of t_{rr}

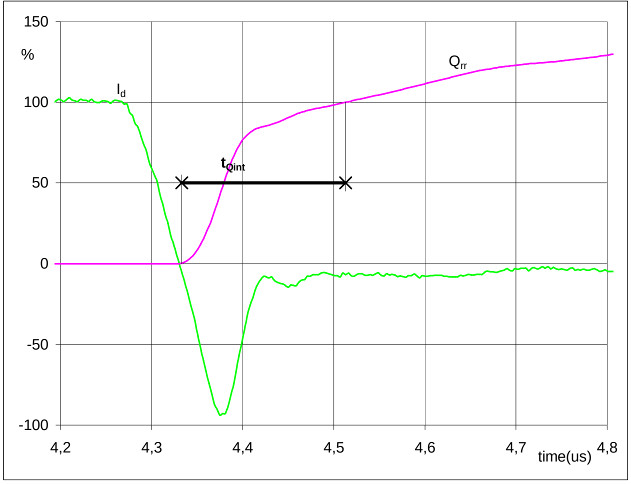


V_d (100%) =	350	V
I_d (100%) =	583	A
I_{RRM} (100%) =	-545	A
t_{rr} =	0,09	μs

Switching Definitions Neutral Point

Figure 8 Half Bridge FWD

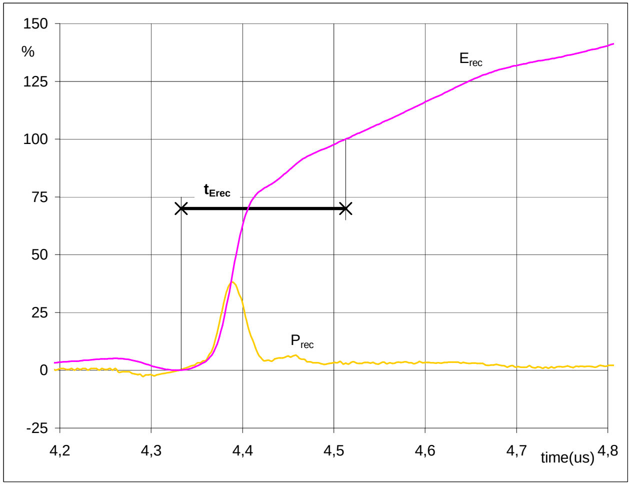
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	583	A
Q_{rr} (100%) =	31,59	µC
t_{Qint} =	0,33	µs

Figure 9 Half Bridge FWD

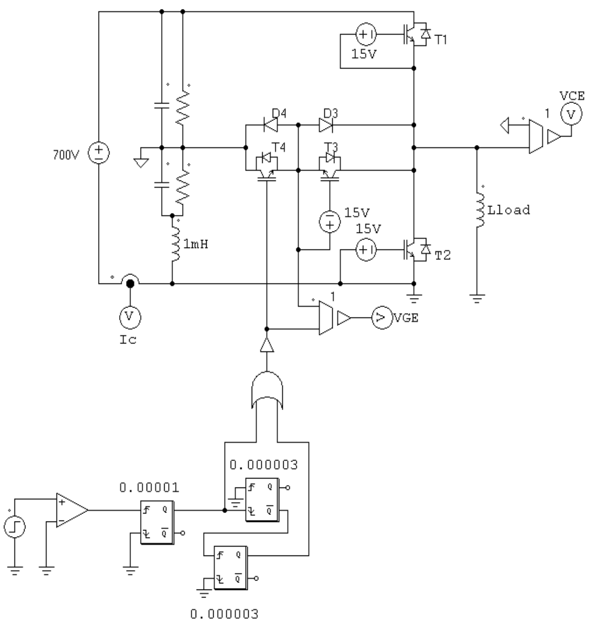
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	203,90	kW
E_{rec} (100%) =	7,18	mJ
$t_{E\,rec}$ =	0,33	µs

Neutral Point switching measurement circuit

Figure 10



Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

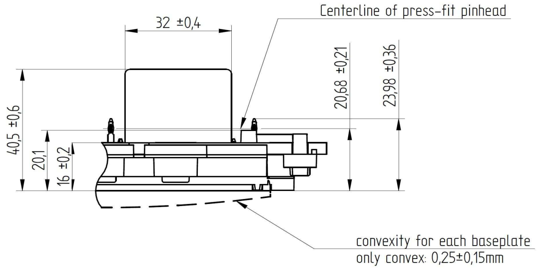
Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard	70-W212NMC600SH01-M700P	M700P	M700P

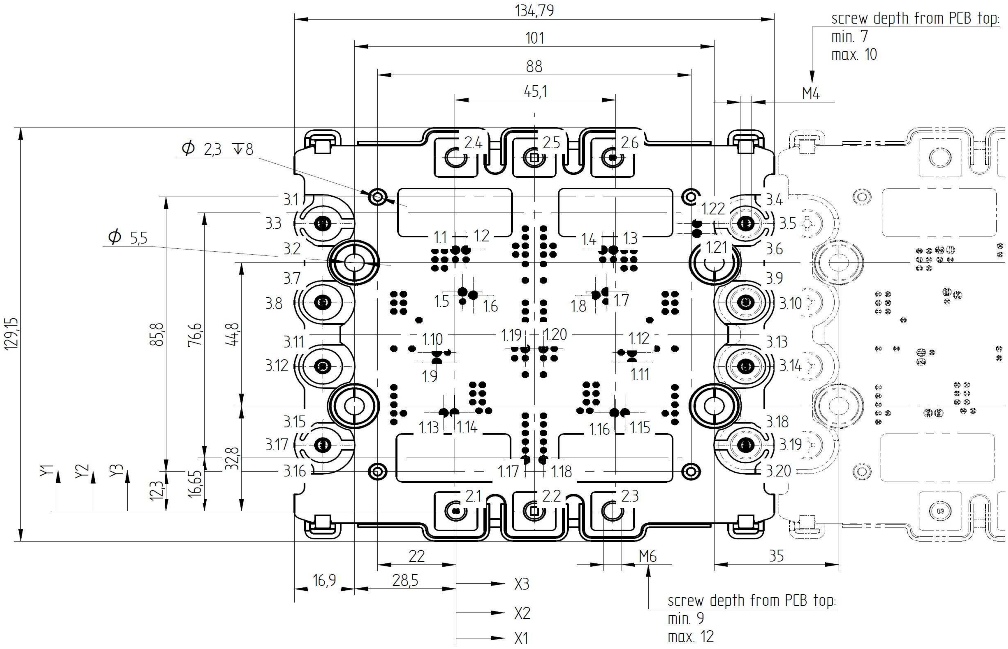
Outline

Driver pins				
Pin	X1	Y1	Function	Group
1.1	-0,2	81,6	G1-1	T1
1.2	2,8	81,6	E1-1	T1
1.3	44,2	81,6	G1-2	T1
1.4	41,2	81,6	E1-2	T1
1.5	1,85	68,5	E2-1	T2
1.6	4,85	67,5	G2-1	T2
1.7	42,2	68,5	E2-2	T2
1.8	39,2	67,5	G2-2	T2
1.9	-5,4	46,6	G3-1	T3
1.10	-5,4	49,6	E3-1	T3
1.11	49,4	46,6	G3-2	T3
1.12	49,4	49,6	E3-2	T3
1.13	-3,45	30,7	E4-1	T4
1.14	-0,45	30,7	G4-1	T4
1.15	47,5	30,7	E4-2	T4
1.16	44,5	30,7	G4-2	T4
1.17	19,5	16	Desat-DC+	
1.18	24,6	16	Desat-DC+	
1.19	19,5	50,8	Desat-GND	
1.20	24,6	50,8	Desat-GND	
1.21	67,7	86,7	NTC	
1.22	67,7	89,8	NTC	

Low current connections			
M4 screw	X3	Y3	Function
3.1	-37	89,8	TR+
3.2	-37	89,8	DC+
3.3	-37	89,8	Neutral
3.4	81,4	89,8	TR+
3.5	81,4	89,8	Neutral
3.6	81,4	89,8	DC+
3.7	-37	65,2	CE
3.8	-37	65,2	Neutral
3.9	81,4	65,2	CE
3.10	81,4	65,2	Neutral
3.11	-37	45,2	Phase
3.12	-37	45,2	Neutral
3.13	81,4	45,2	Phase
3.14	81,4	45,2	Neutral
3.15	-37	20,6	DC-
3.16	-37	20,6	TR-
3.17	-37	20,6	Neutral
3.18	81,4	20,6	DC-
3.19	81,4	20,6	Neutral
3.20	81,4	20,6	TR-

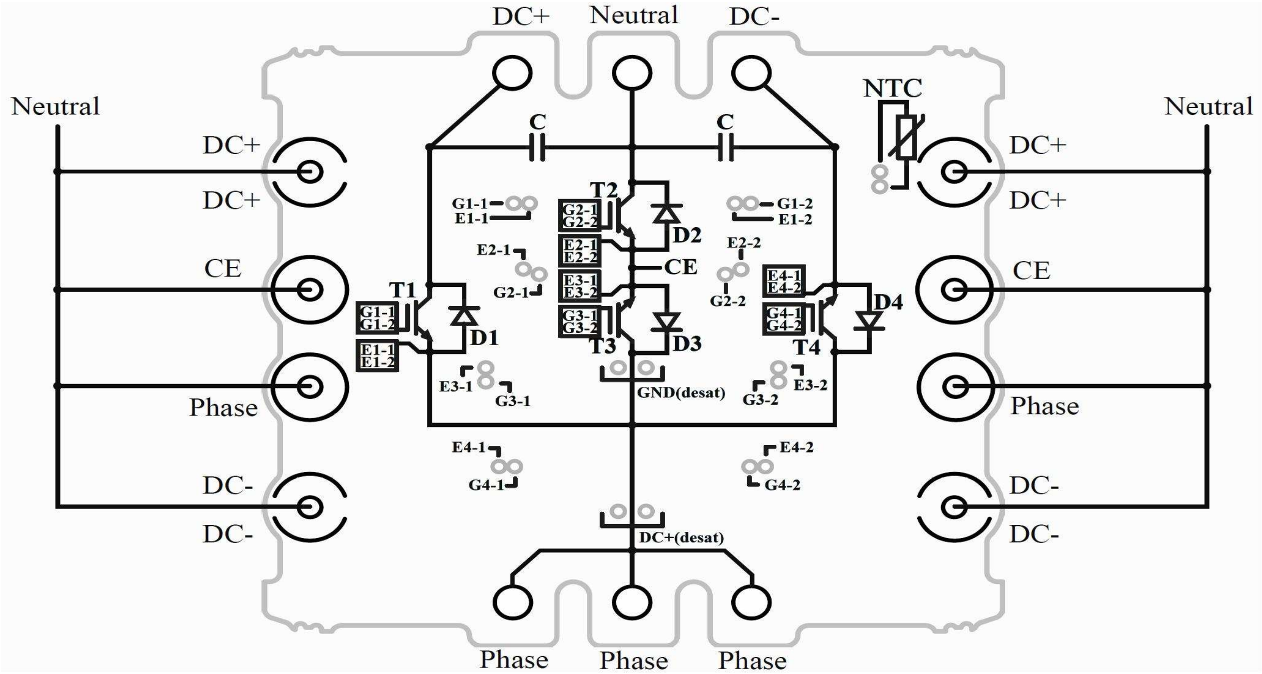
Power connections			
M6 screw	X2	Y2	Function
2.1	0	0	Phase
2.2	22	0	Phase
2.3	44	0	Phase
2.4	0	110,4	DC+
2.5	22	110,4	Neutral
2.6	44	110,4	DC-





Ordering Code and Marking - Outline - Pinout

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T4	IGBT	1200V	600A	Half Bridge Switch	
D1,D4	FWD	1200V	300A	Half Bridge Diode	
T2,T3	IGBT	600V	600A	Neutral Point Switch	
D2,D3	FWD	600V	600A	Neutral Point Diode	
NTC	NTC	-	-	Thermistor	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.