flow MNPC 4w — 1200V/600A

Features

- Mixed voltage NPC
- Low inductive
- High power screw interface
- Integrated DC-snubber capacitors

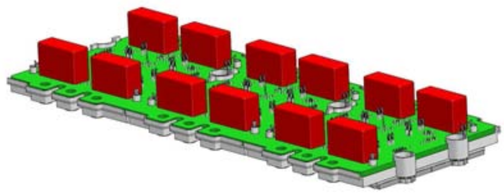
Target Applications

- Solar inverter
- UPS
- High speed motor drive

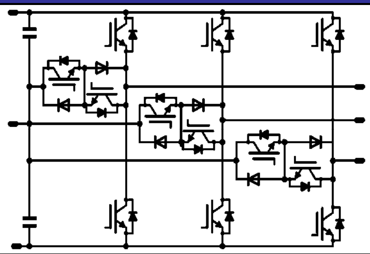
Types

- 70-W612M3A600SC-M200E

FlowScrew WideBody 12mm 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	432 560	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max	1800	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max; T_h=80°C T_c=80°C	910 1378	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	$T_j$max		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	362 475	A
Surge forward current	I_{FSM}	t_p = 10 ms, sine halfwave; T_{vj} < 150°C	1250	A
I2t-value	I^2t	t_p = 10 ms, sine halfwave; T_{vj} < 150°C	7800	A^2s
Repetitive peak forward current	I_{FRM}	t_P = 1 ms; T_{vj} < 150°C	1200	A
Power dissipation per FWD	P_{tot}	$T_j=T_j$max; T_h=80°C T_c=80°C	502 760	W
Maximum Junction Temperature	$T_j$max		175	°C

Maximum Ratings

Tj=25℃, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
neutral point IGBT (T2 , T3)					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_jmax$	T_h=80℃ T_c=80℃	422 551	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by T_jmax		1800	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	668 1012	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150℃ V_{GE}=15V		6 360	μs V
Turn off safe operating area (RBSOA)	I_{cmax}	$V_{CE\ max}$ = 1200V $T_{vj\ max}$= 150℃		1200	A
Maximum Junction Temperature	T_jmax			175	℃
half bridge FWD (D1 , D4)					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25℃		1200	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80℃ T_c=80℃	369 488	A
Surge forward current	I_{FSM}	t_p=10ms , sin 180°	T_j=150℃	3600	A
I2t-value	I^2t			16200	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax		1800	A
Power dissipation per FWD	P_{tot}	$T_j=T_jmax$	T_h=80℃ T_c=80℃	682 1033	W
Maximum Junction Temperature	T_jmax			175	℃
DC link Capacitor					
Max.DC voltage	V_{MAX}		T_{cmax}=100℃	630	V
General Module Properties					
Material of module baseplate				Cu	
Material of internal isulation				Al2O3	
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	℃
Operation temperature under switching condition	T_{op}	for power part		-40…+(Tjmax - 25)	℃
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}			0,024	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		600	Tj=25°C Tj=125°C	1,4	2,16 2,42	2,4	V
Collector-emitter cut-off current incl. FWD	I_{CES}		0	1200		Tj=25°C Tj=125°C			0,2	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			2800	nA
Integrated Gate resistor	R_{gint}							1,25		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=2 Ω Rgon=2 Ω	±15	350	600	Tj=25°C Tj=125°C		389 405		ns
Rise time	t_r					Tj=25°C Tj=125°C		78 85		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		429 486		
Fall time	t_f					Tj=25°C Tj=125°C		57 86		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		21 27		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		21 31		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		37200		pF
Output capacitance	C_{oss}							2320		
Reverse transfer capacitance	C_{rss}							2040		
Gate charge	Q_{Gate}		15	960	640	Tj=25°C		2800		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,10		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,07		
neutral point FWD (D2 , D3)										
FWD forward voltage	V_F				600	Tj=25°C Tj=125°C	1,27	1,67 1,65	1,97	V
Peak reverse recovery current	I_{RRM}	Rgon=2 Ω	±15	350	600	Tj=25°C Tj=125°C		251 311		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		191 281		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=125°C		21 41		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		4449 1803		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=125°C		4 8		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,19		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,13		
neutral point IGBT (T2 , T3)										
Gate emitter threshold voltage	$V_{GE(th)}$	V_{CE}=V_{GE}			0,0096	Tj=25°C Tj=125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		600	Tj=25°C Tj=125°C	1,05	1,57 1,80	1,85	V
Collector-emitter cut-off incl FWD	I_{CES}		0	600		Tj=25°C Tj=125°C			0,0304	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=125°C			2400	nA
Integrated Gate resistor	R_{gint}							0,5		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=2 Ω Rgon=2 Ω	±15	350	600	Tj=25°C Tj=125°C		337 345		ns
Rise time	t_r					Tj=25°C Tj=125°C		72 75		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=125°C		413 440		
Fall time	t_f					Tj=25°C Tj=125°C		35 53		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		20 29		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		18 25		
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_{Gate}		15	480	600	Tj=25°C		3760		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,14		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,09		

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℃ Tj=125℃	1	2,23 2,31	2,7	V
Reverse leakage current	I_r			1200		Tj=25℃ Tj=125℃			720	µA
Peak reverse recovery current	I_{RRM}	Rgon=2 Ω	±15	350	600	Tj=25℃ Tj=125℃		289 397		A
Reverse recovery time	t_{rr}					Tj=25℃ Tj=125℃		90 473		ns
Reverse recovered charge	Q_{rr}					Tj=25℃ Tj=125℃		18 65		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25℃ Tj=125℃		8488 6098		A/µs
Reverse recovery energy	E_{rec}					Tj=25℃ Tj=125℃		3 14		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,14		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,09		
DC link Capacitor										
C value	C							2 * 0,68		µF
Thermistor										
Rated resistance	R					T=25℃		22000		Ω
Deviation of R25	ΔR/R	R100=1486 Ω				T=100℃	-5		+5	%
Power dissipation	P					T=25℃		200		mW
Power dissipation constant						Tj=25℃		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25℃		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25℃		3996		K
Vincotech NTC Reference									B	
Module Properties										
Module inductance (from chips to PCB)	L_{sCE}							5		nH
Module inductance (from PCB to PCB using Intercon board)	L_{sCE}							3		nH
Chip module lead resistance, terminals -chip	$R_{cc'1+EE'}$	Tc=25℃, per switch						tbd.		mΩ
Resistance of Intercon boards (from PCB to PCB using Intercon board)	$R_{cc'1+EE'}$							1,5		mΩ
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								710	g

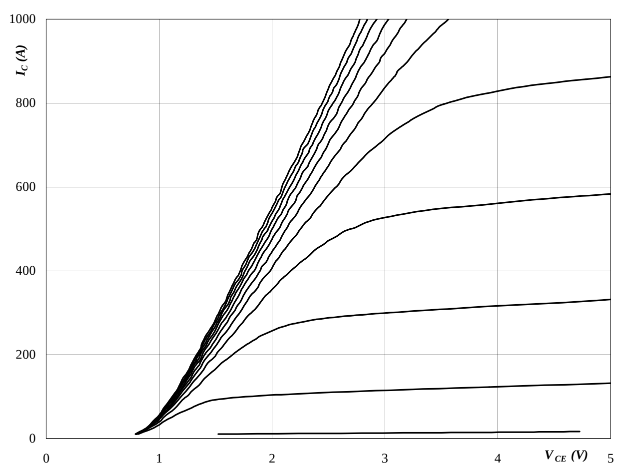
Buck

half bridge IGBT and neutral point FWD

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



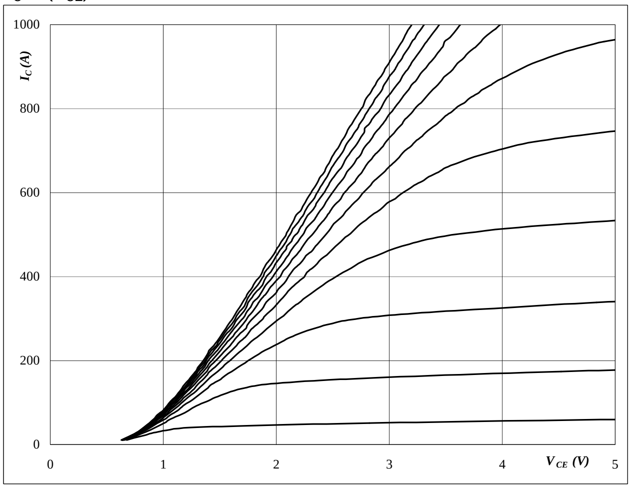
At

t_p =	350	µs
T_j =	25	℃
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



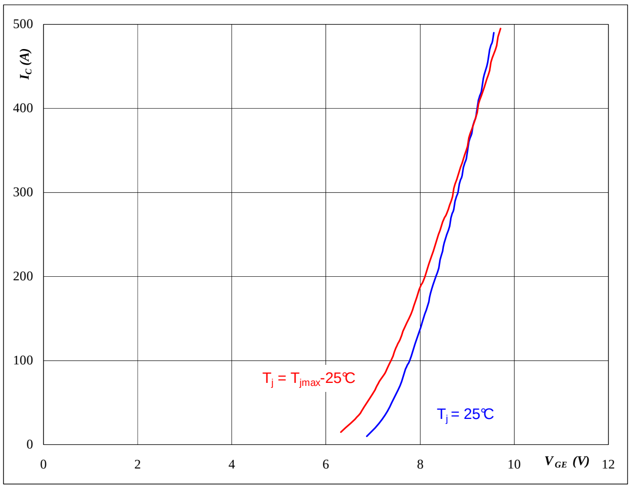
At

t_p =	350	µs
T_j =	125	℃
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



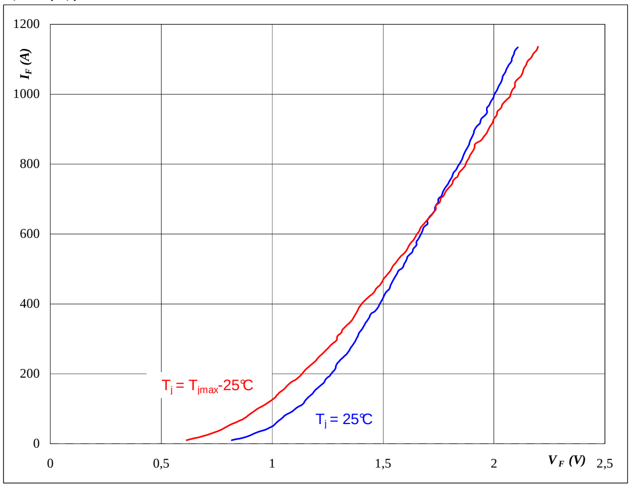
At

t_p =	350	µs
V_{CE} =	10	V

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	350	µs

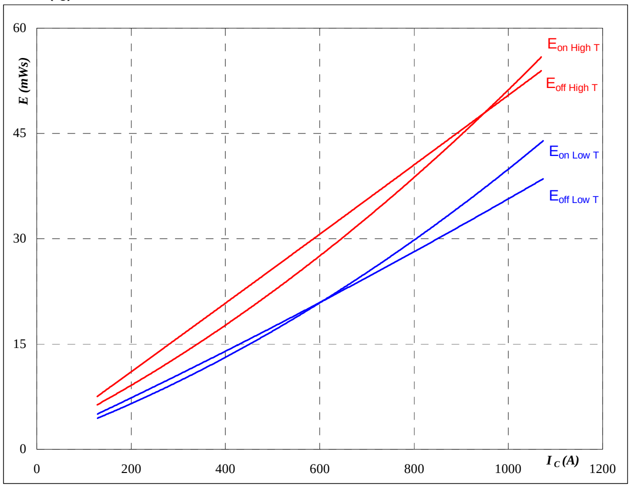
Buck

half bridge IGBT and neutral point FWD

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



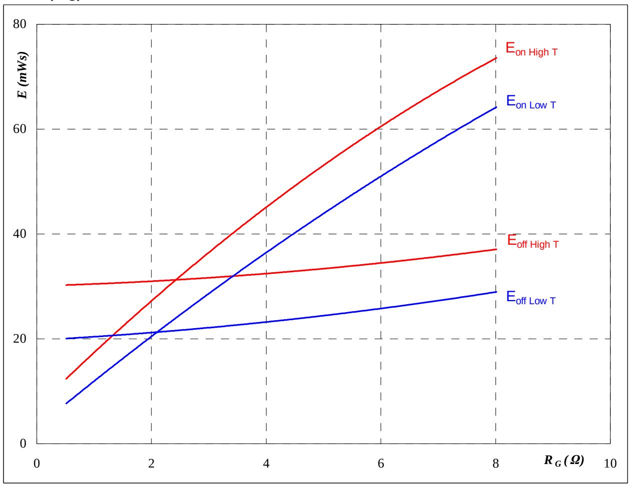
With an inductive load at

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



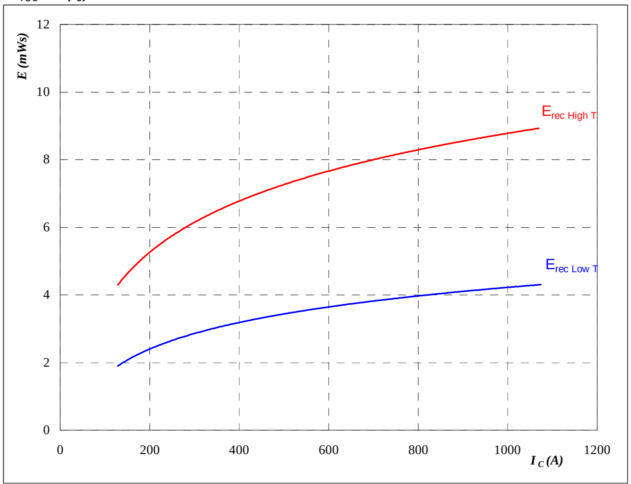
With an inductive load at

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	596	A

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



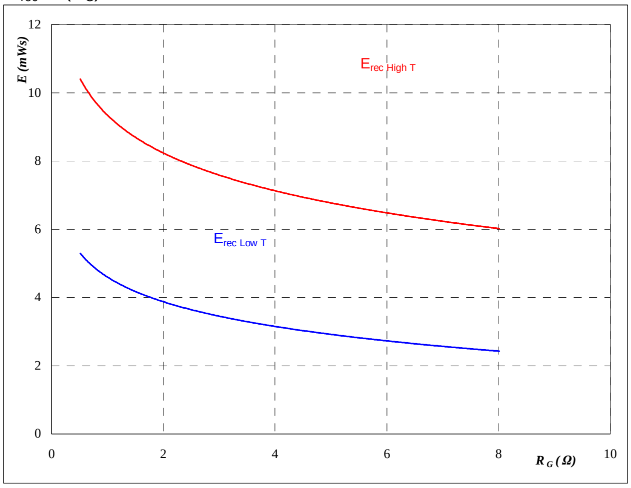
With an inductive load at

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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

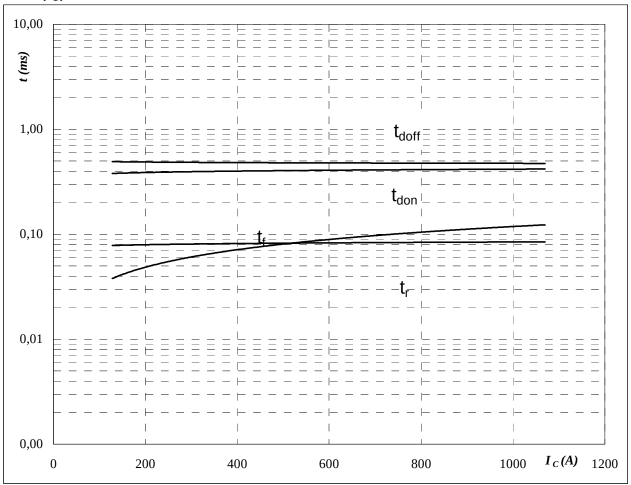
T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	596	A

Buck

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



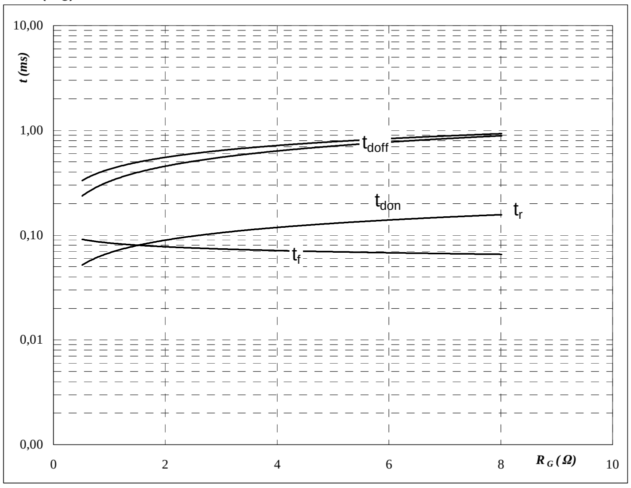
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



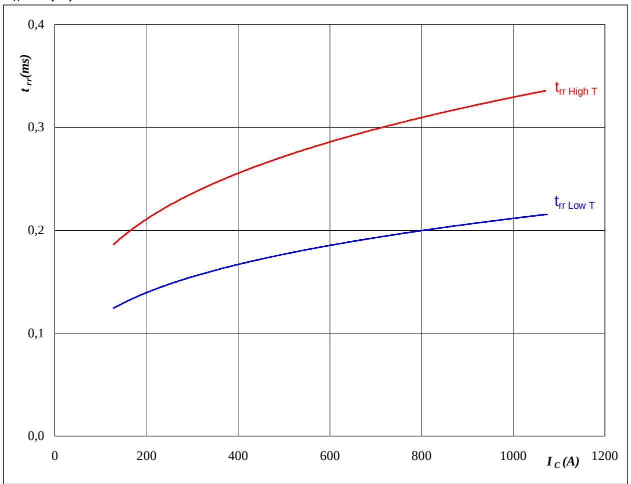
With an inductive load at

T_j =	125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	596	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



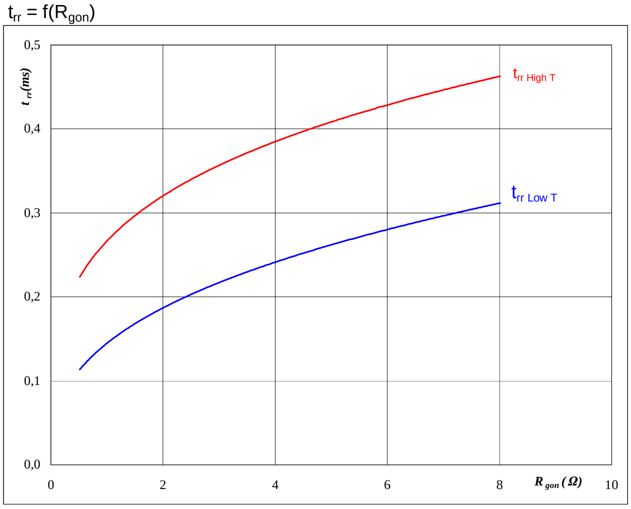
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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	℃
V_R =	350	V
I_F =	596	A
V_{GE} =	±15	V

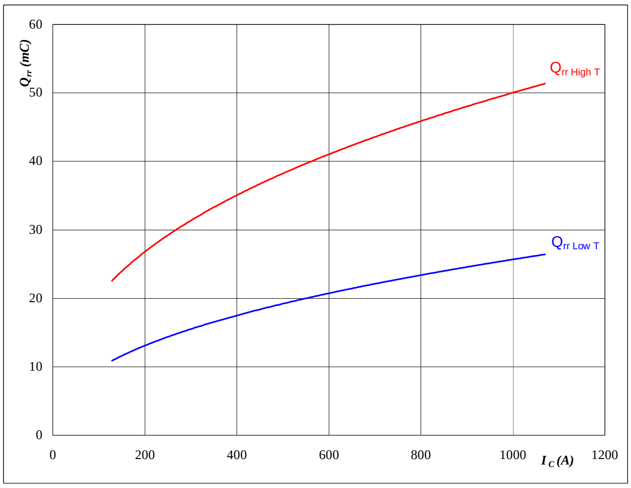
Buck

half bridge IGBT and neutral point FWD

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



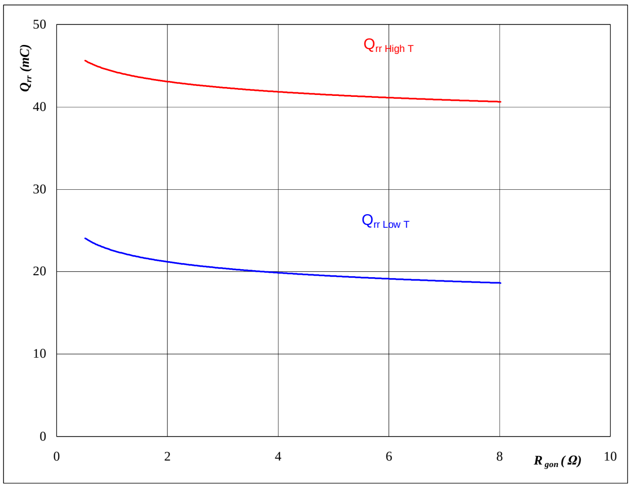
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 14 FWD

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

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



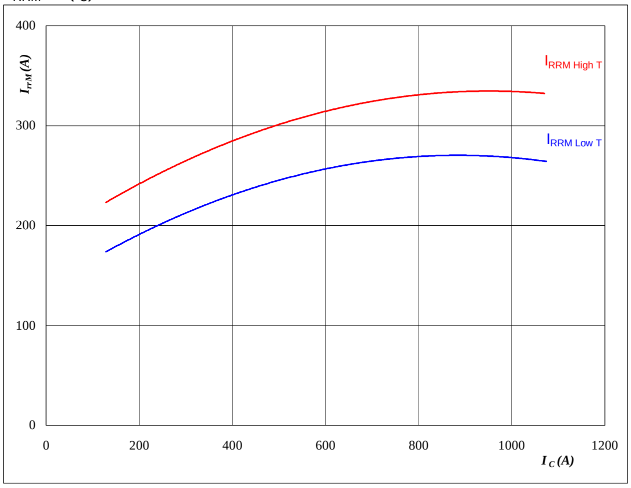
At

T_j =	25/125	℃
V_R =	350	V
I_F =	596	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



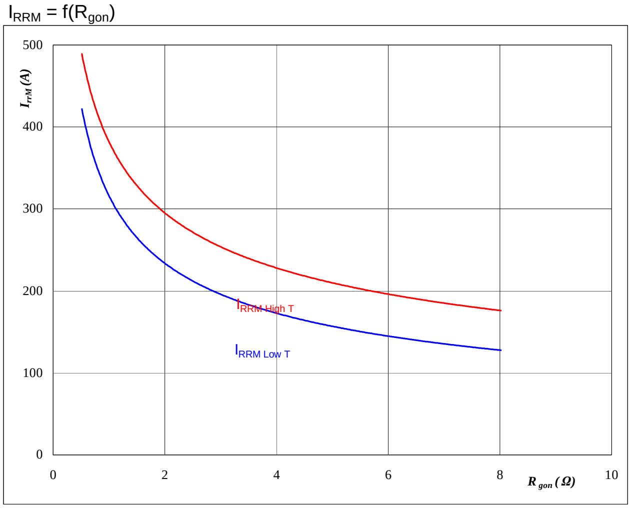
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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	℃
V_R =	350	V
I_F =	596	A
V_{GE} =	±15	V

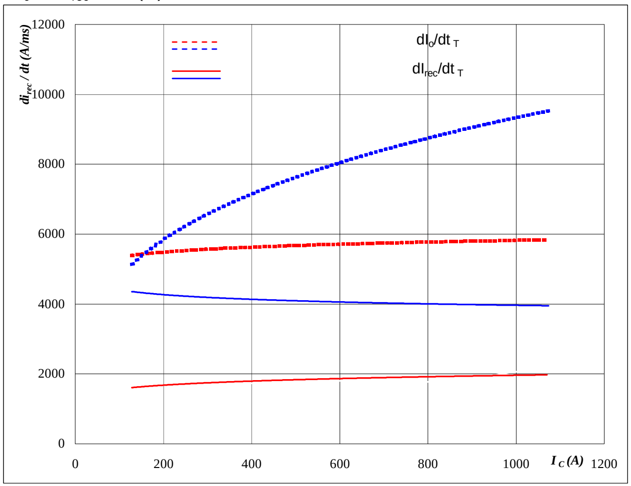
Buck

half bridge IGBT and neutral point FWD

Figure 17 FWD

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

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



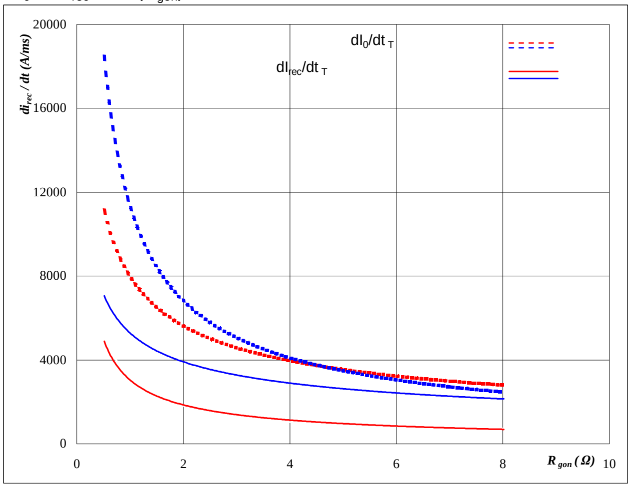
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 18 FWD

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

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



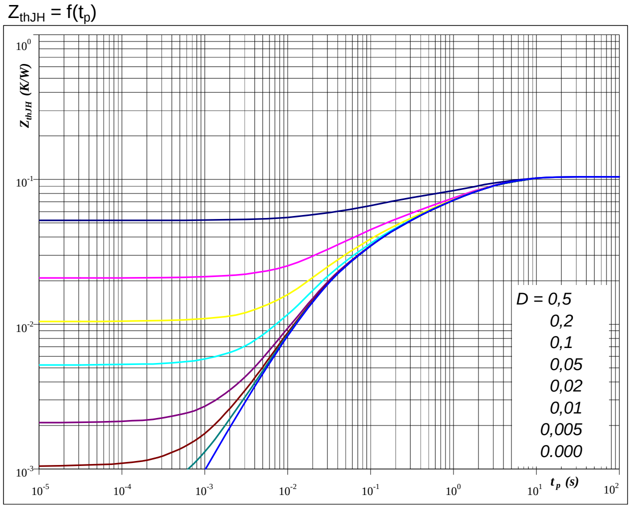
At

T_j =	25/125	℃
V_R =	350	V
I_F =	596	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} =	0,10	K/W

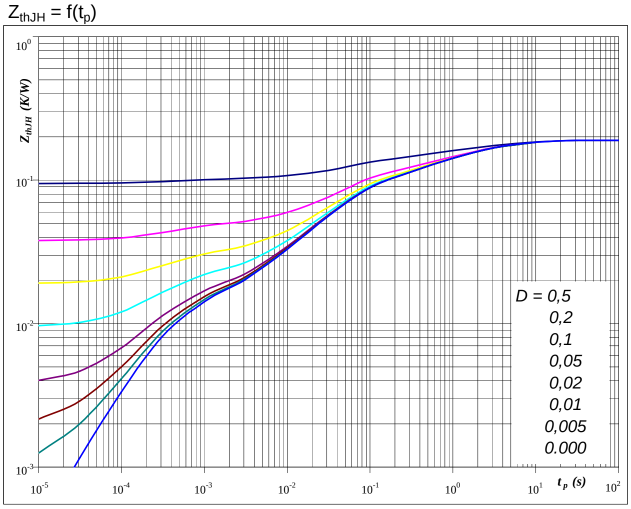
IGBT thermal model values

R (C/W)	Tau (s)
0,03	3,8E+00
0,04	7,5E-01
0,03	9,4E-02
0,01	1,9E-02

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} =	0,19	K/W

FWD thermal model values

R (C/W)	Tau (s)
0,02	8,0E+00
0,05	1,7E+00
0,04	3,2E-01
0,06	4,4E-02
0,01	5,9E-03
0,01	3,4E-04

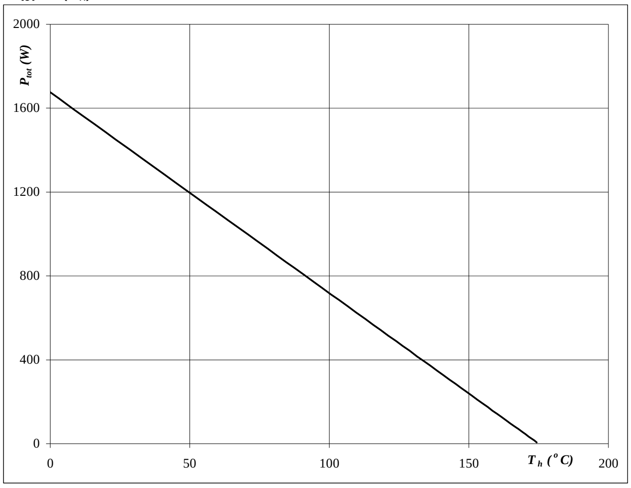
Buck

half bridge IGBT and neutral point FWD

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



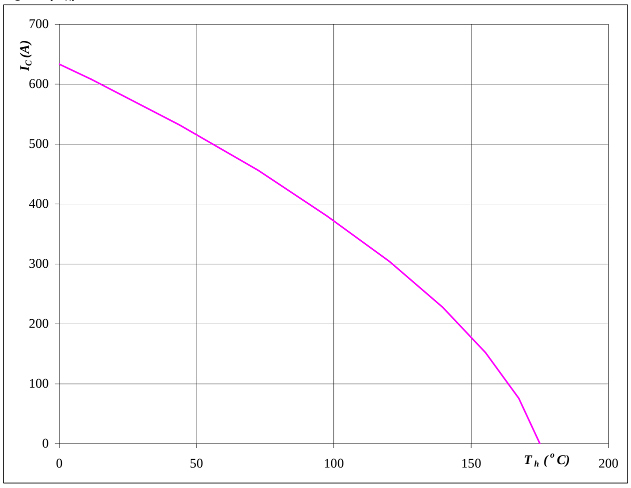
At

T_j = 175 ℃

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

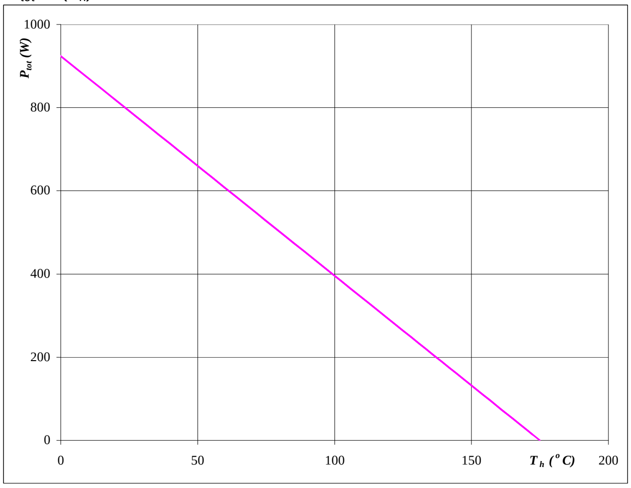
T_j = 175 ℃

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



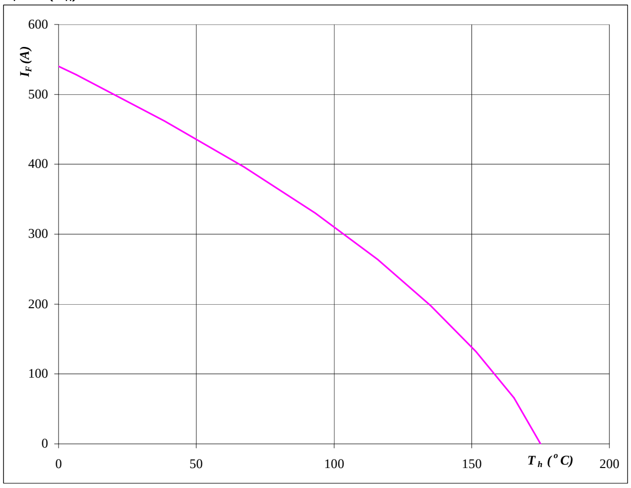
At

T_j = 175 ℃

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 175 ℃

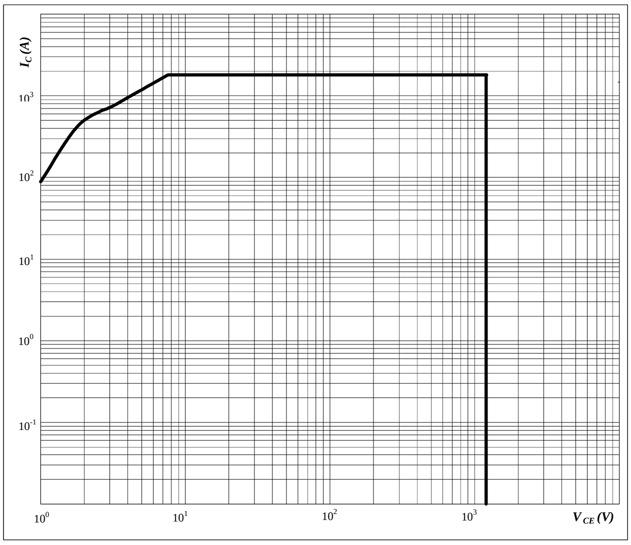
Buck

half bridge IGBT and neutral point FWD

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



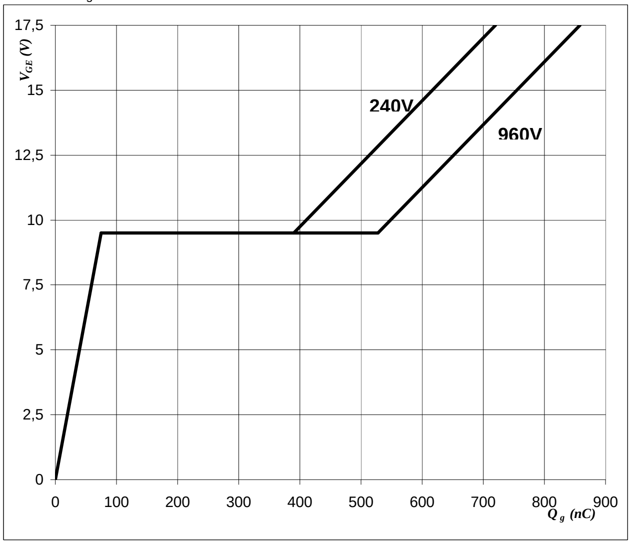
At

D =	single pulse	
Th =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



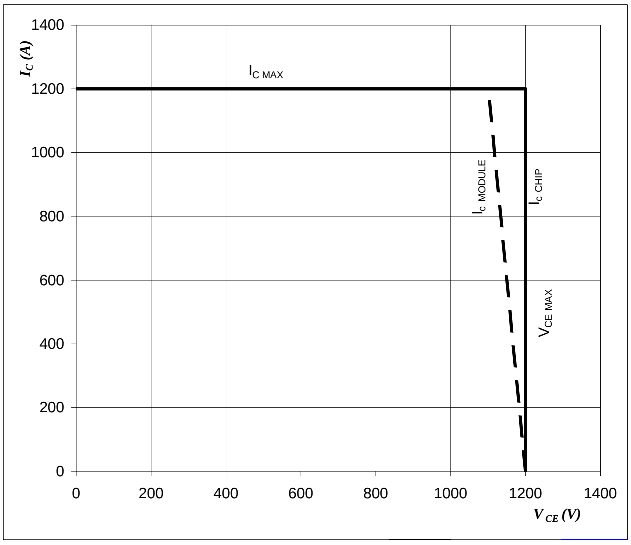
At

I_C =	600	A

Figure 27 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	T_{jmax}-25	ºC
$U_{ccminus}$=U_{ccplus}		
Switching mode :	3 level switching	

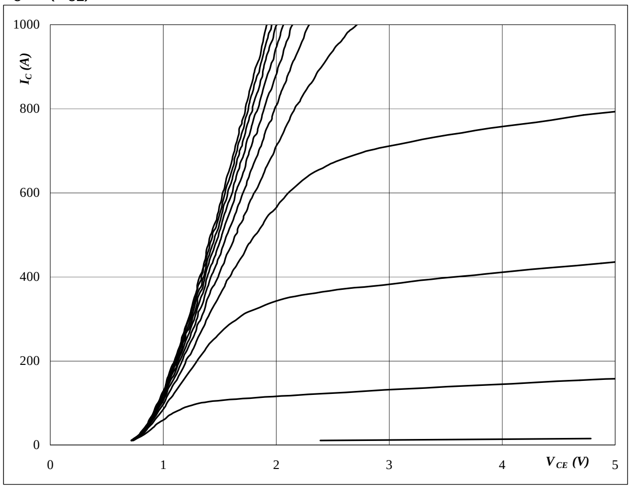
Boost

neutral point IGBT and half bridge FWD

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



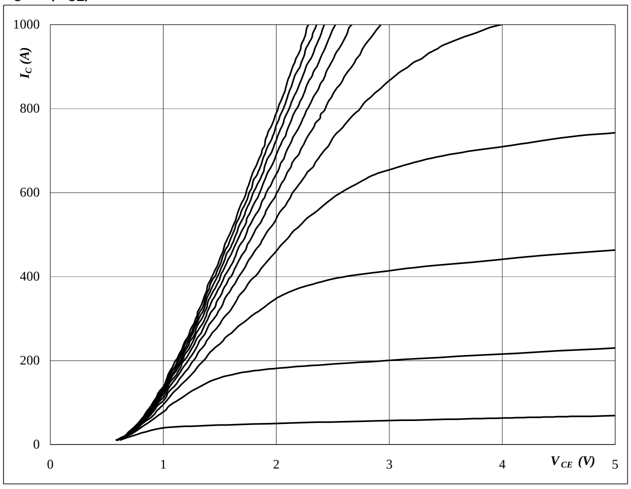
At

t_p =	350	μs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



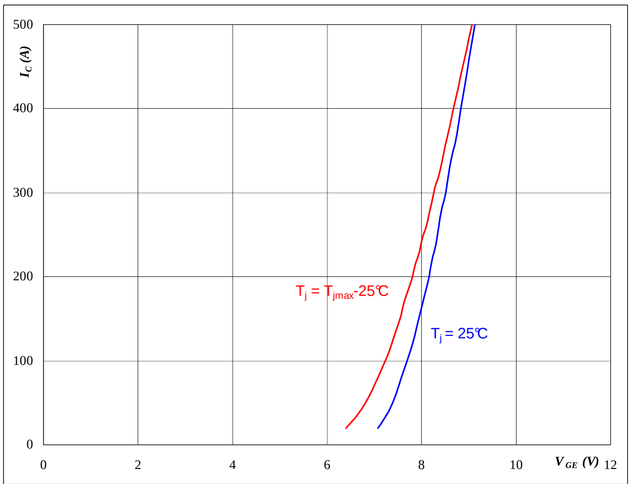
At

t_p =	350	μs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



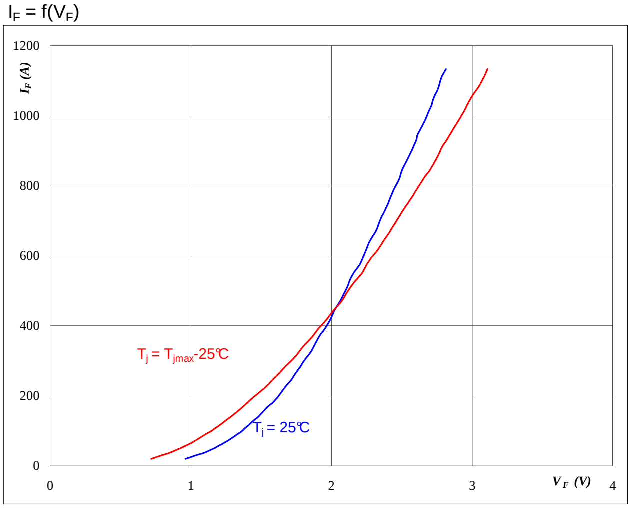
At

t_p =	350	μs
V_{CE} =	0	V

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	350	μs

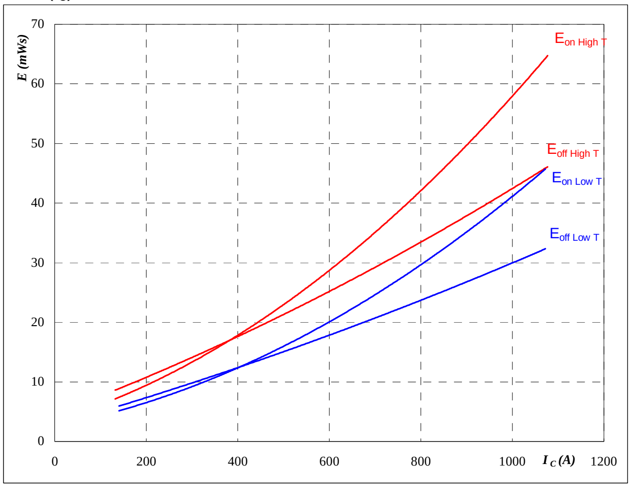
Boost

neutral point IGBT and half bridge FWD

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



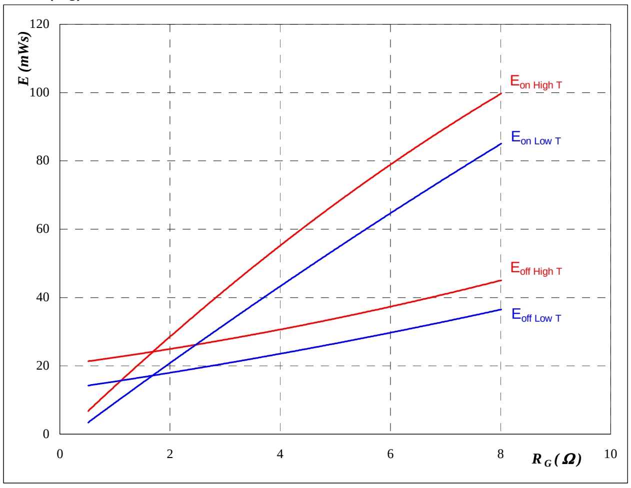
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



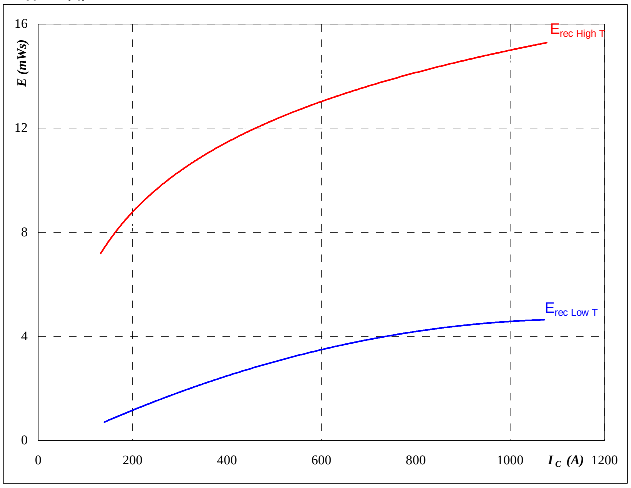
With an inductive load at

T_j =	25/125	°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

$E_{rec} = f(I_c)$



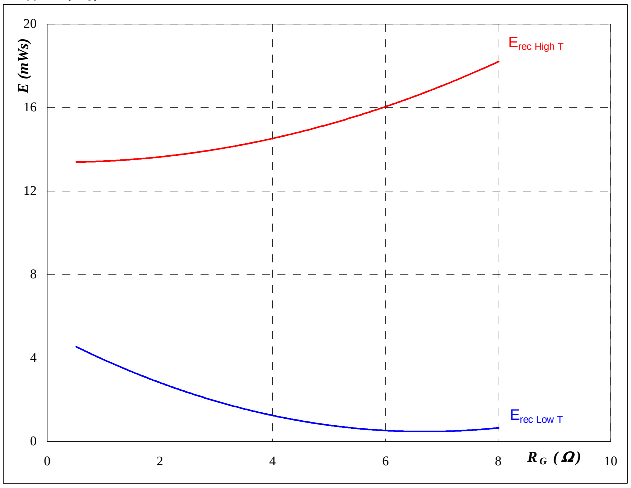
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	600	A

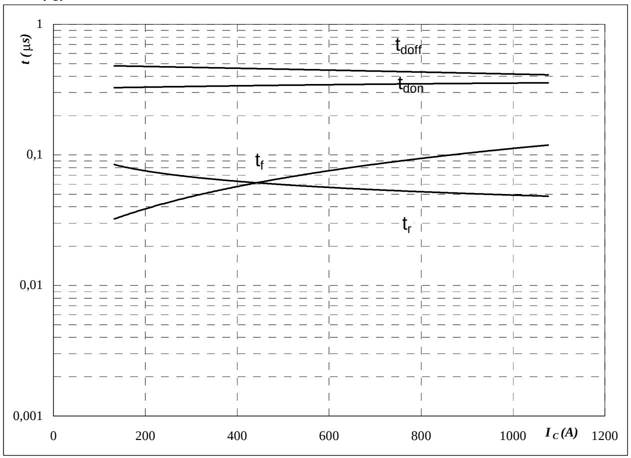
Boost

neutral point IGBT and half bridge FWD

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



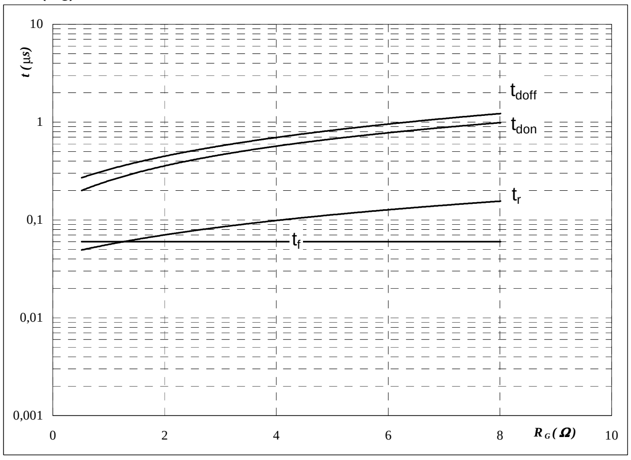
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



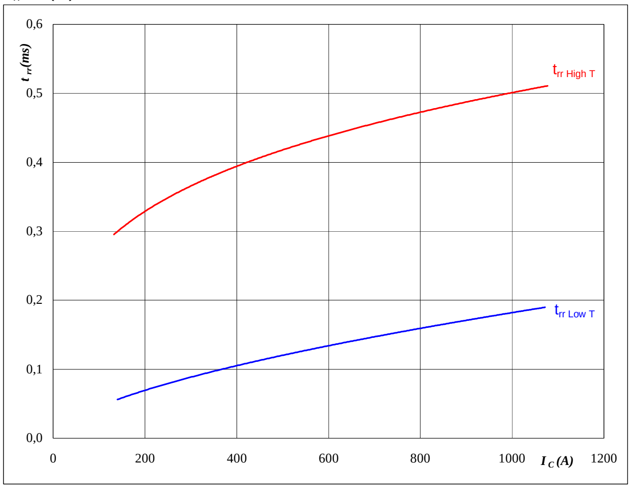
With an inductive load at

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(Ic)



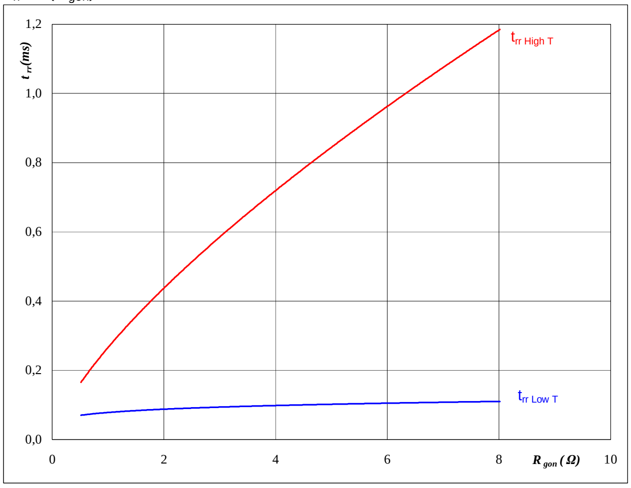
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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	°C
V_R =	350	V
I_F =	600	A
V_{GE} =	±15	V

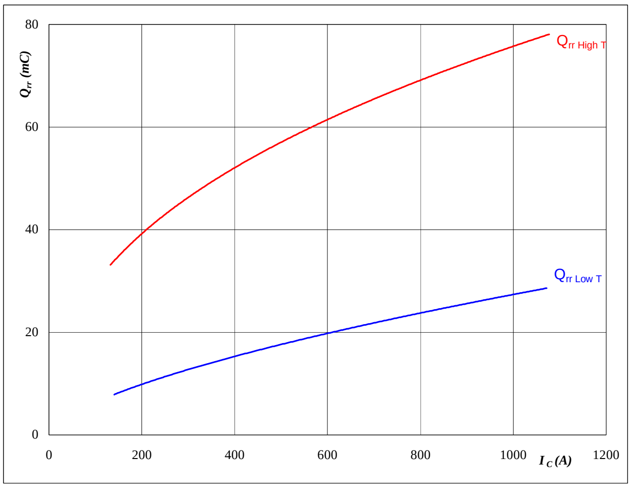
Boost

neutral point IGBT and half bridge FWD

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



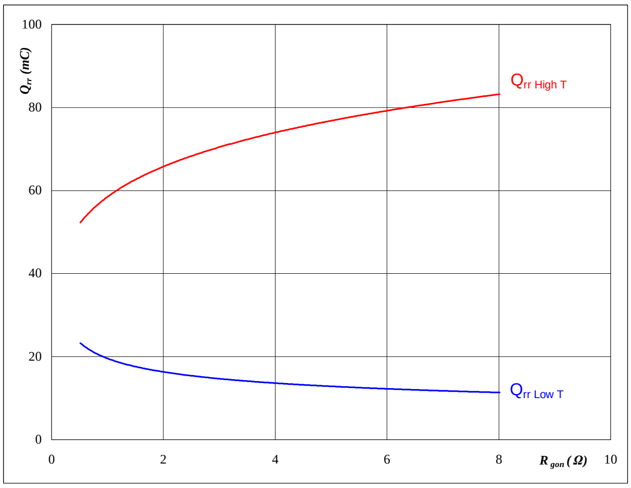
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 14 FWD

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

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



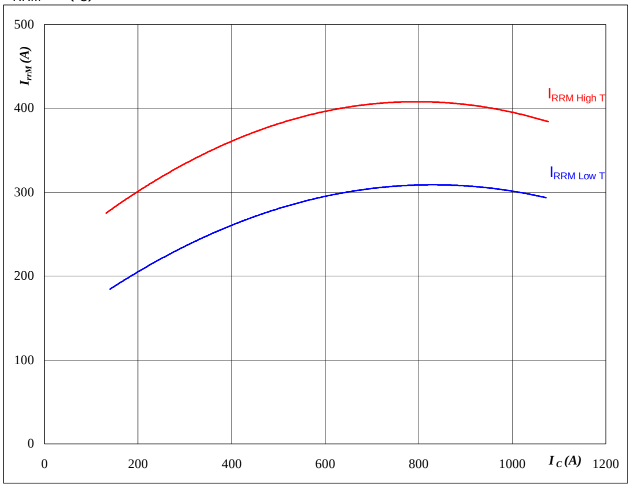
At

T_j =	25/125	℃
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

$I_{RRM} = f(I_C)$



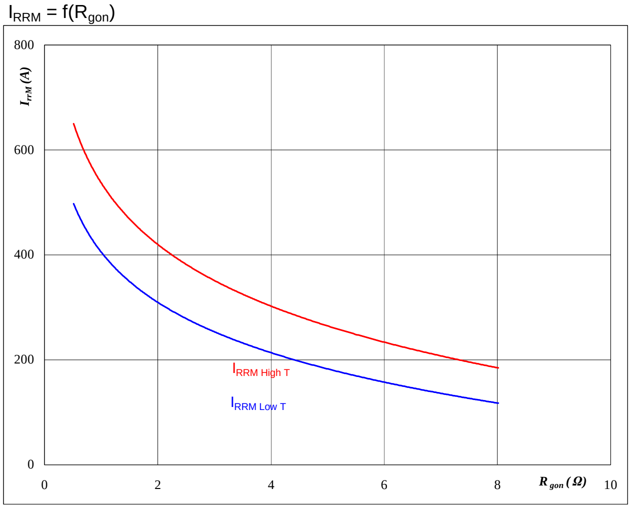
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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	℃
V_R =	350	V
I_F =	600	A
V_{GE} =	±15	V

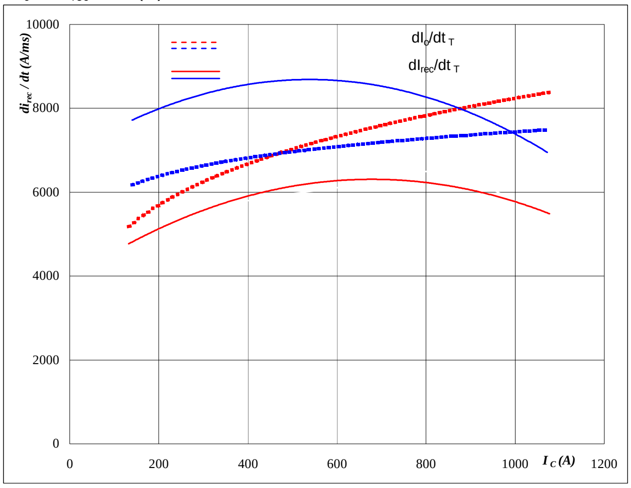
Boost

neutral point IGBT and half bridge FWD

Figure 17 FWD

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

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



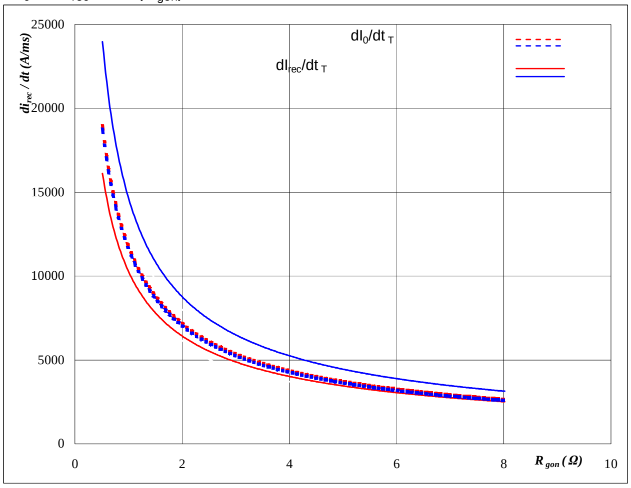
At

T_j =	25/125	℃
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

Figure 18 FWD

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

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



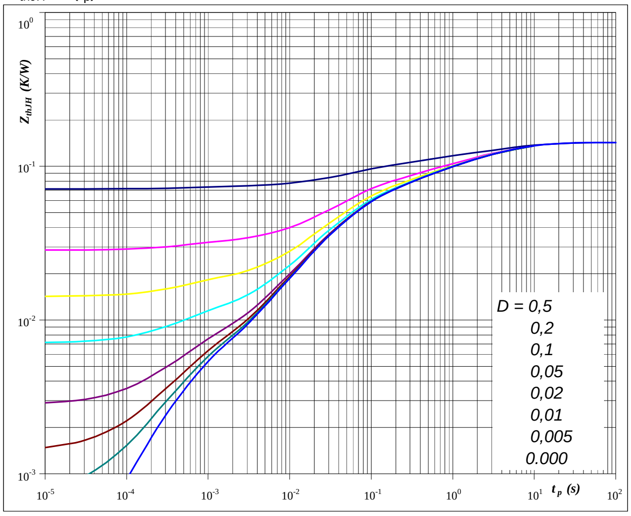
At

T_j =	25/125	℃
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 =	tp / T	
R_{thJH} =	0,14	K/W

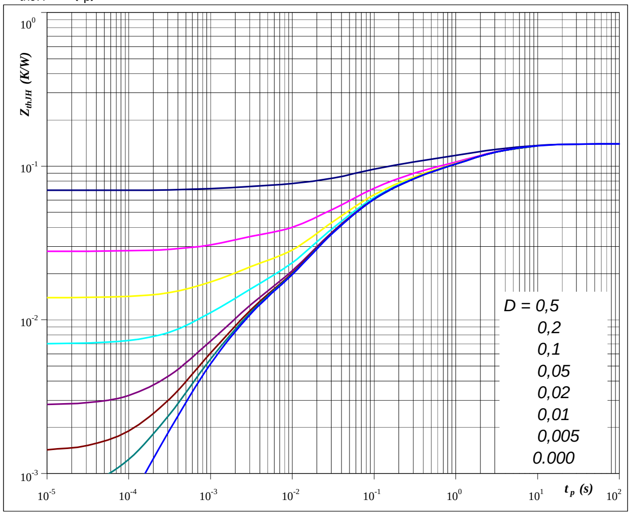
IGBT thermal model values

R (C/W)	Tau (s)
0,02	8,94
0,04	2,07
0,03	0,29
0,04	0,05
0,01	0,01

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	0,14	K/W

FWD thermal model values

R (C/W)	Tau (s)
0,02	6,10
0,04	1,41
0,04	0,18
0,04	0,03
0,01	0,00

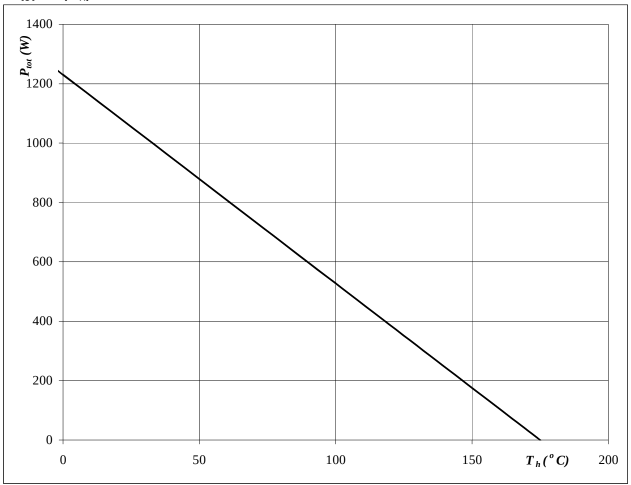
Boost

neutral point IGBT and half bridge FWD

Figure 21	IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



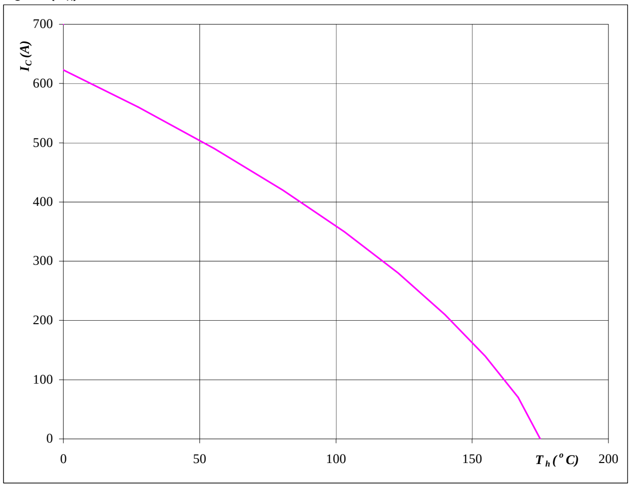
At

T_j = 175 ºC

Figure 22	IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

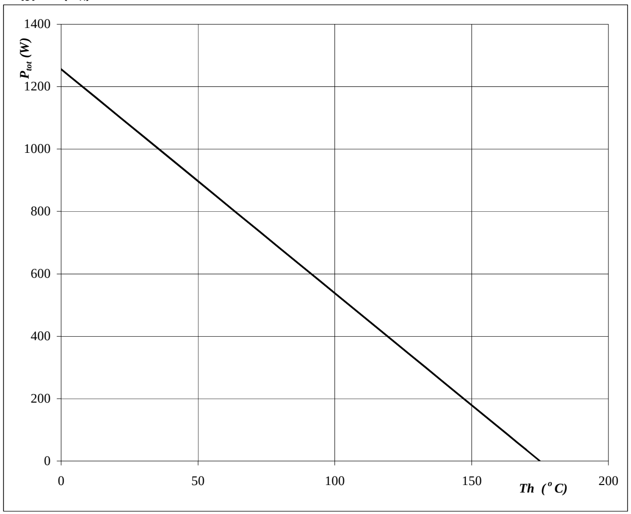
T_j = 175 ºC

V_{GE} = 15 V

Figure 23	FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



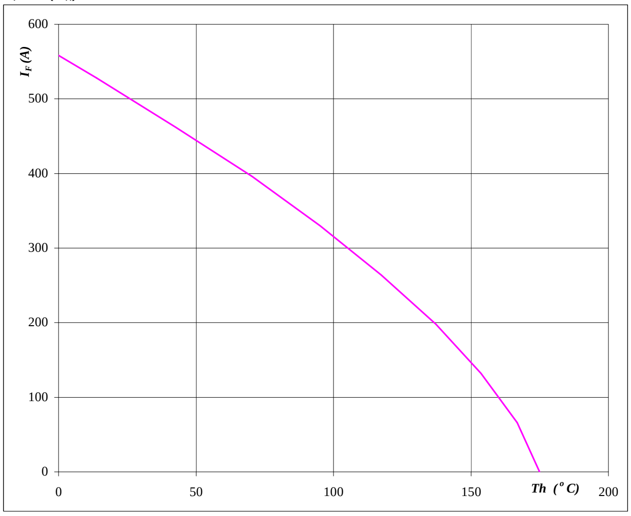
At

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

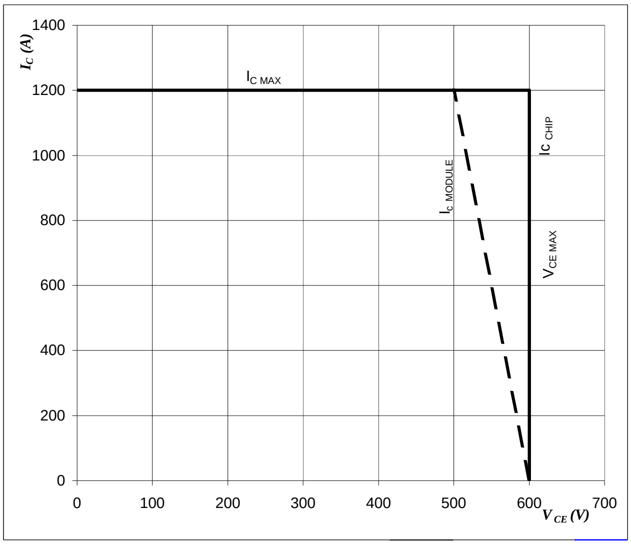
Boost

neutral point IGBT

Figure 25	IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

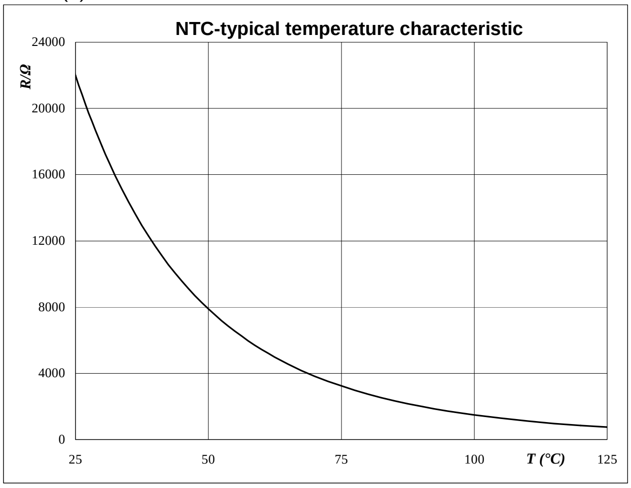
$U_{ccminus}$=U_{ccplus}

Switching mode : 3 level switching

Thermistor

Figure 1	Thermistor

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



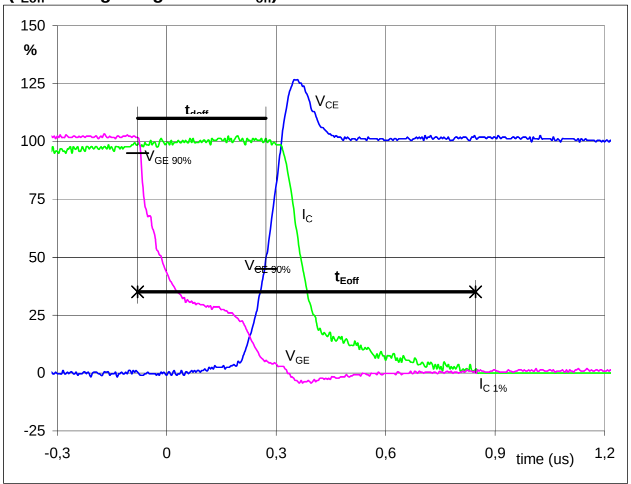
Switching Definitions half bridge IGBT

General conditions

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

Figure 1 half bridge IGBT

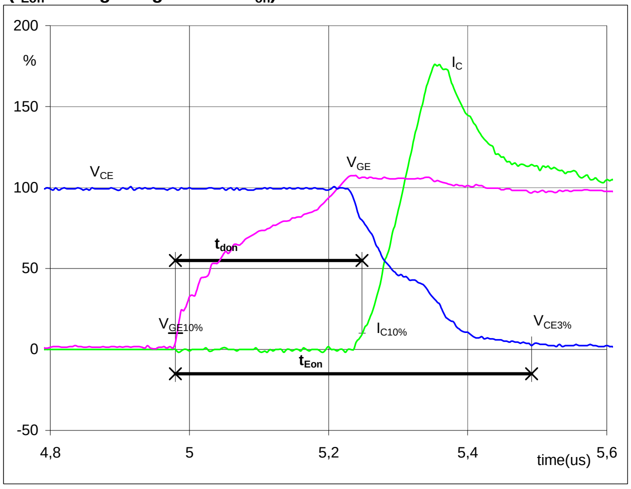
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	591	A
t_{doff} =	0,37	μs
t_{Eoff} =	0,93	μs

Figure 2 half bridge IGBT

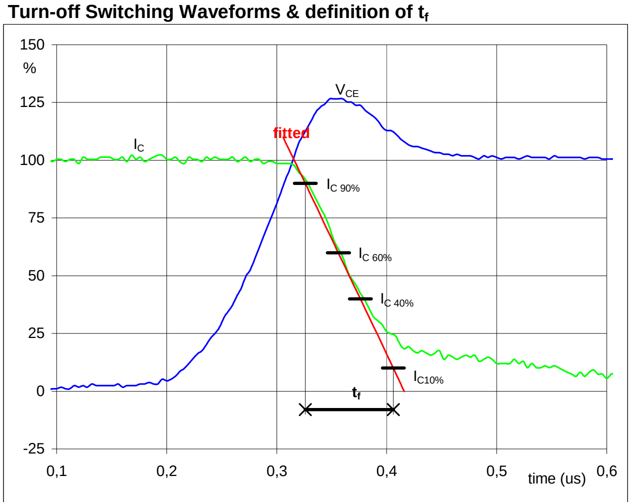
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	591	A
t_{don} =	0,26	μs
t_{Eon} =	0,51	μs

Figure 3 half bridge IGBT

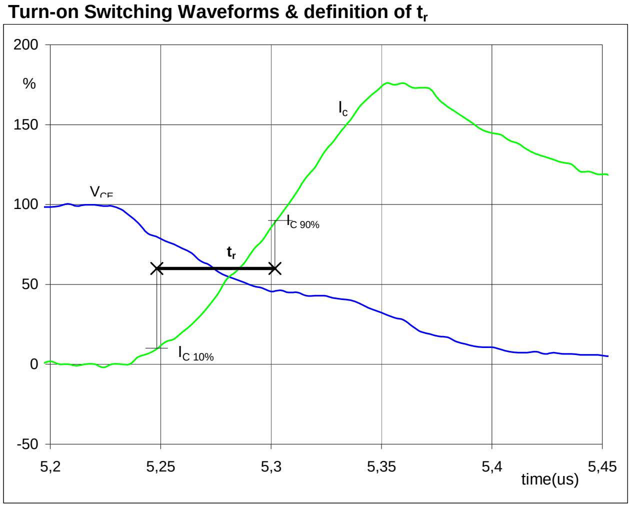
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	591	A
t_f =	0,08	μs

Figure 4 half bridge IGBT

Turn-on Switching Waveforms & definition of t_r

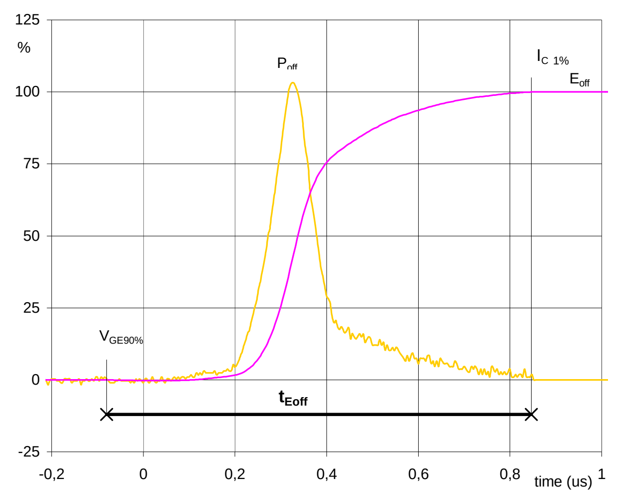


V_C (100%) =	350	V
I_C (100%) =	591	A
t_r =	0,06	μs

Switching Definitions half bridge IGBT

Figure 5 half bridge IGBT

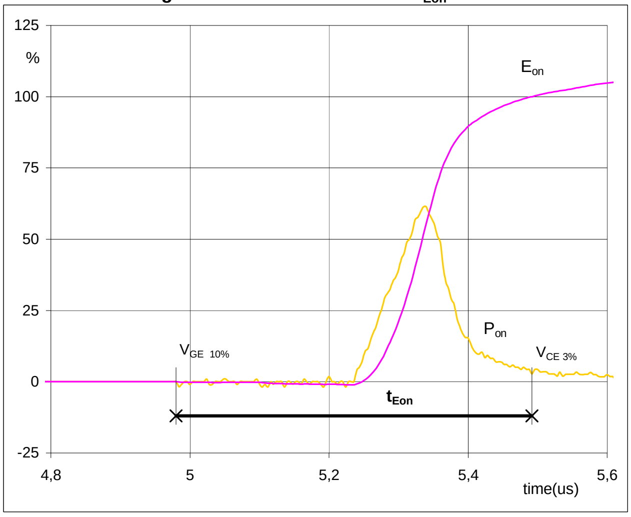
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	206,68	kW
E_{off} (100%) =	30,27	mJ
t_{Eoff} =	0,93	μs

Figure 6 half bridge IGBT

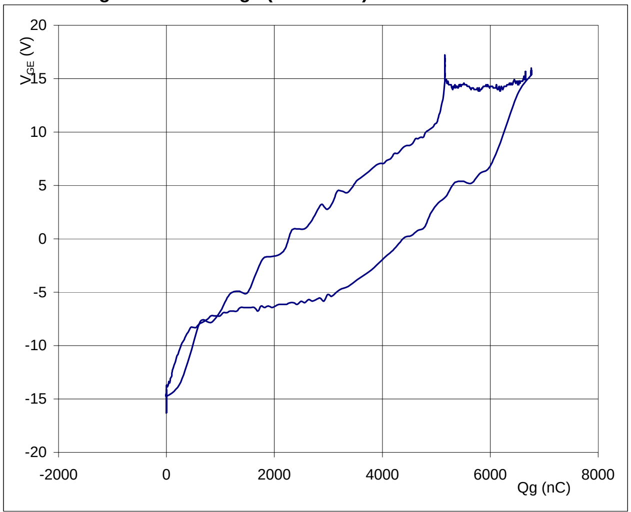
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	206,68	kW
E_{on} (100%) =	12,81	mJ
t_{Eon} =	0,51	μs

Figure 7 half bridge IGBT

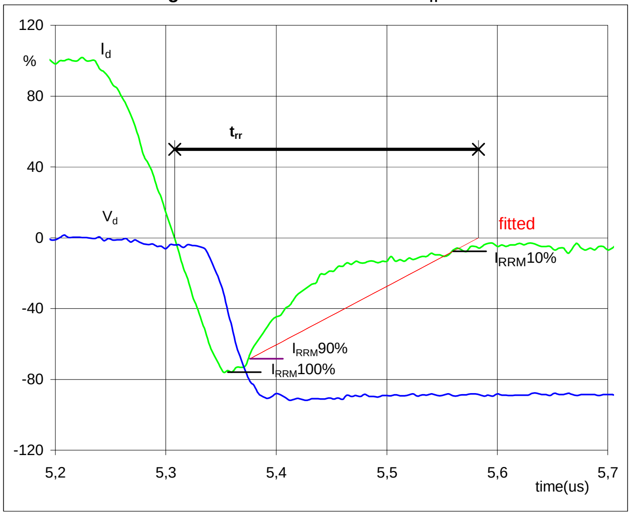
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	350	V
I_C (100%) =	591	A
Q_g =	6760,86	nC

Figure 8 neutral point FWD

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

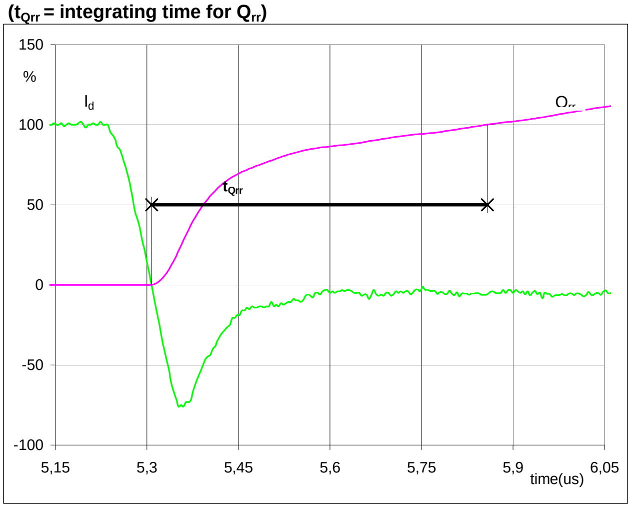


V_d (100%) =	350	V
I_d (100%) =	591	A
I_{RRM} (100%) =	-457	A
t_{rr} =	0,25	μs

Switching Definitions half bridge IGBT

Figure 9 neutral point FWD

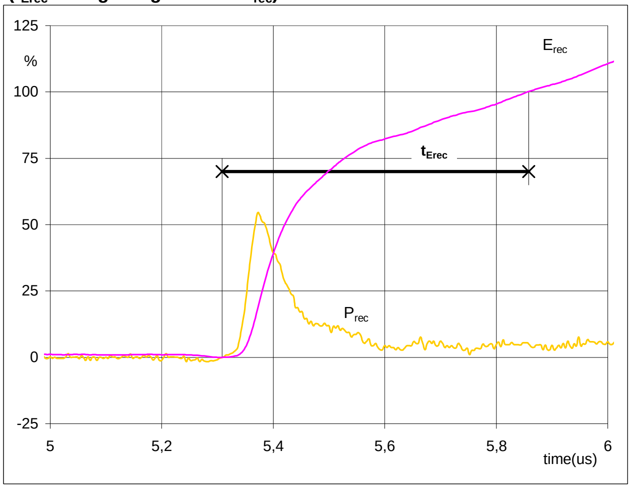
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	591	A
Q_{rr} (100%) =	47,04	µC
t_{Qrr} =	0,55	µs

Figure 10 neutral point FWD

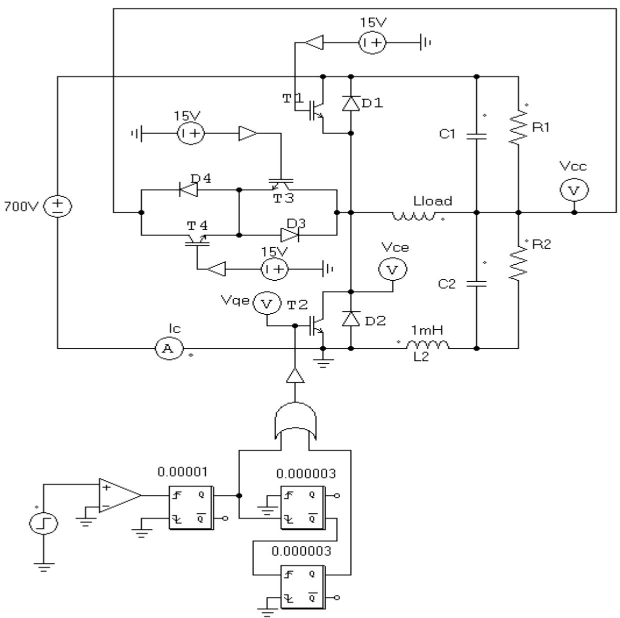
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	206,68	kW
E_{rec} (100%) =	10,70	mJ
t_{Erec} =	0,55	µs

half bridge IGBT switching measurement circuit

Figure 11



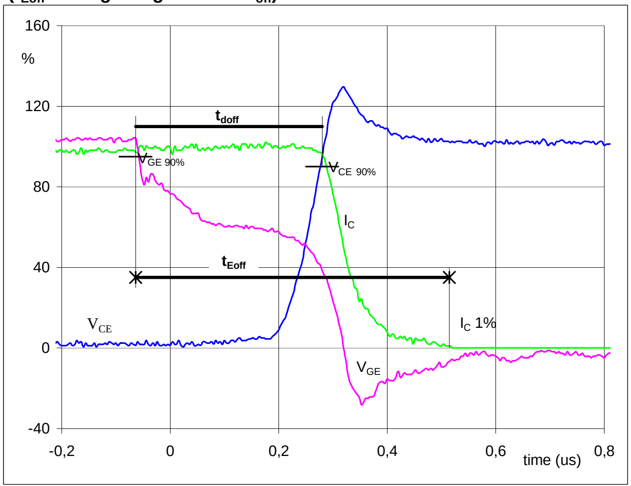
Switching Definitions neutral point IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

Figure 1 neutral point IGBT

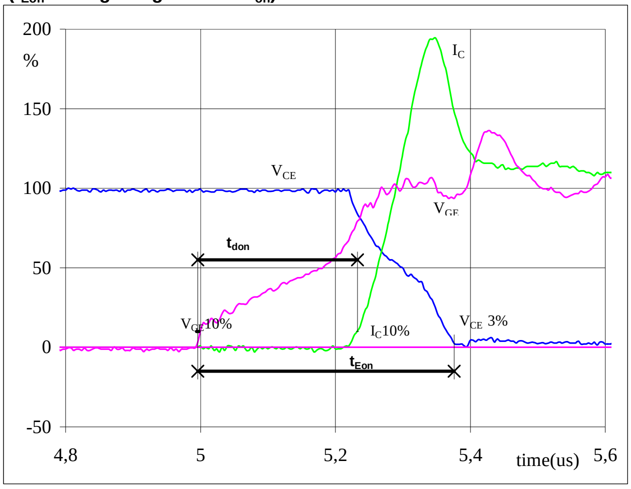
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	592	A
t_{doff} =	0,23	µs
t_{Eoff} =	0,58	µs

Figure 2 neutral point IGBT

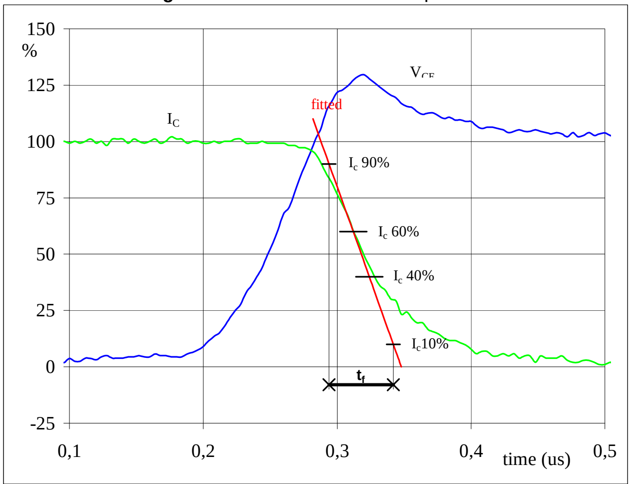
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	592	A
t_{don} =	0,25	µs
t_{Eon} =	0,38	µs

Figure 3 neutral point IGBT

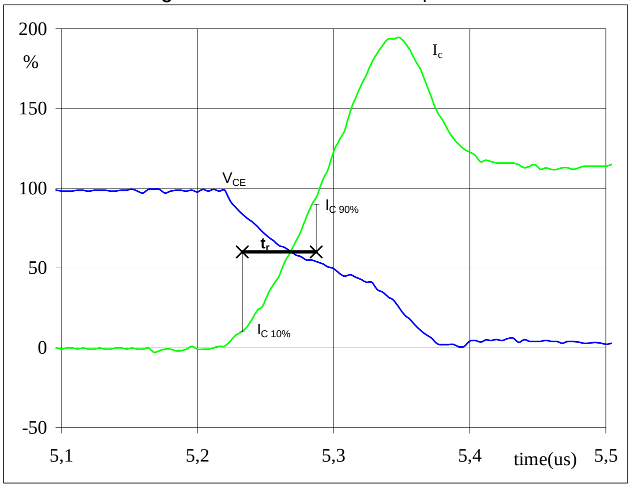
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	592	A
t_f =	0,067	µs

Figure 4 neutral point IGBT

Turn-on Switching Waveforms & definition of t_r

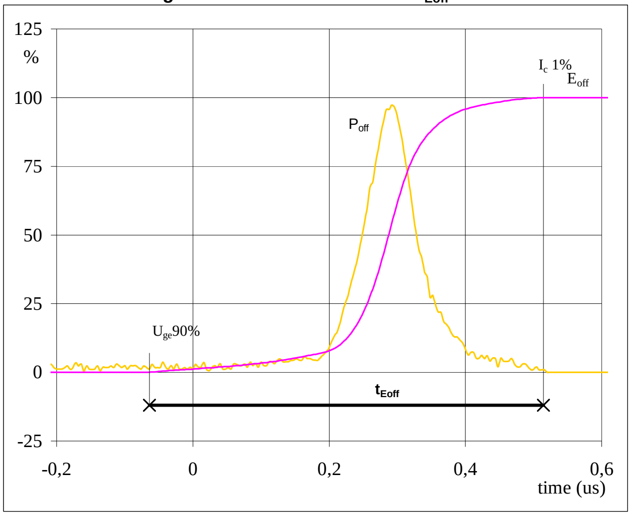


V_C (100%) =	700	V
I_C (100%) =	592	A
t_r =	0,053	µs

Switching Definitions neutral point IGBT

Figure 5 neutral point IGBT

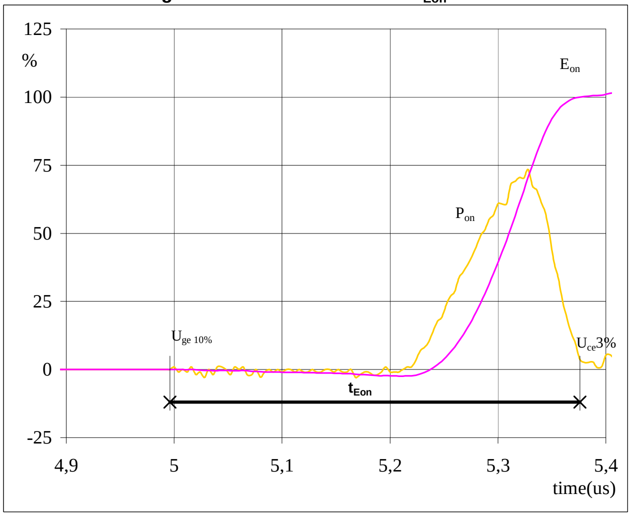
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	414,61	kW
E_{off} (100%) =	22,22	mJ
t_{Eoff} =	0,58	µs

Figure 6 neutral point IGBT

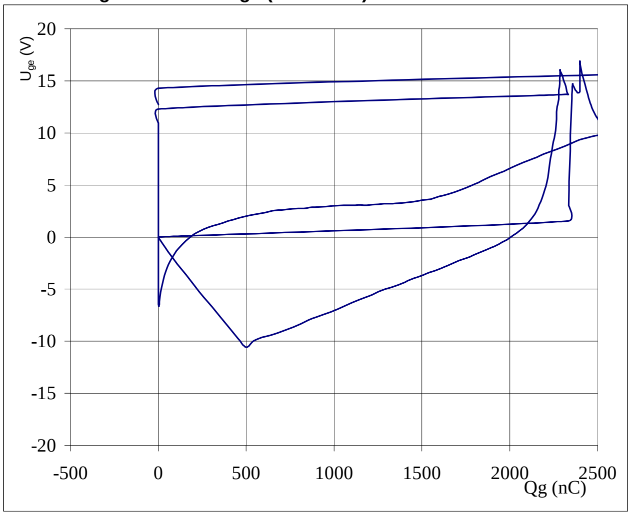
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	414,6107	kW
E_{on} (100%) =	13,39	mJ
t_{Eon} =	0,38	µs

Figure 7 neutral point IGBT

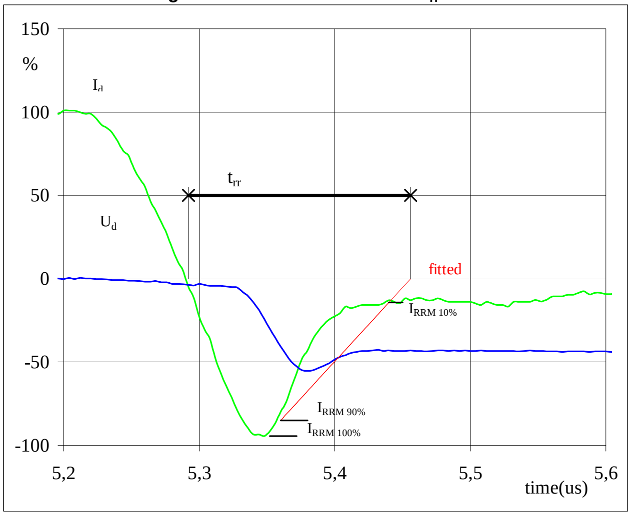
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	700	V
I_C (100%) =	592	A
Q_g =	3441,54	nC

Figure 8 half bridge FWD

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

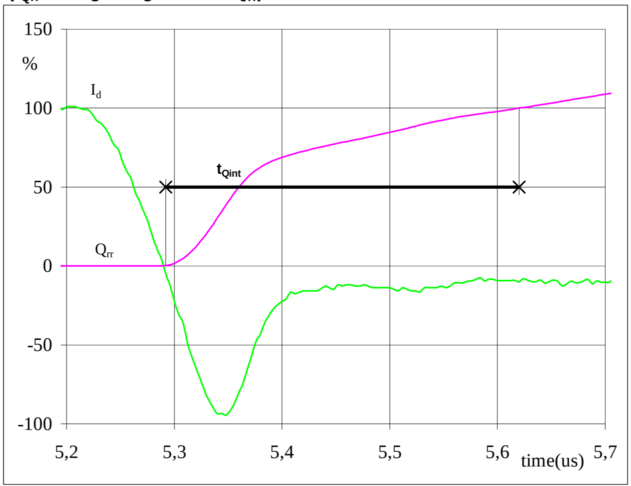


V_d (100%) =	700	V
I_d (100%) =	592	A
I_{RRM} (100%) =	-568	A
t_{rr} =	0,29	µs

Switching Definitions neutral point IGBT

Figure 9 half bridge FWD

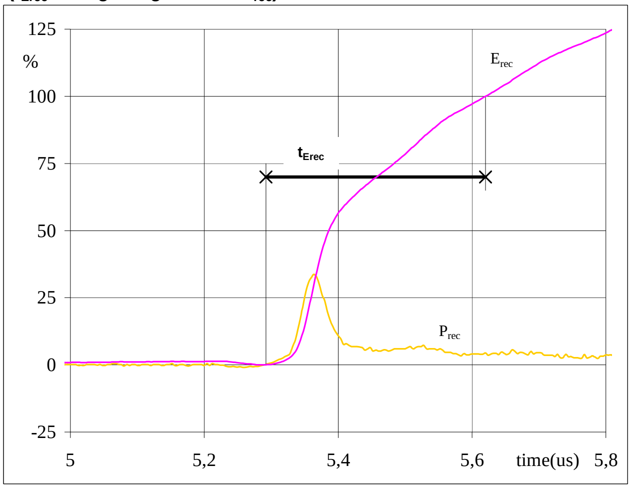
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	592	A
Q_{rr} (100%) =	60,53	μC
t_{Qint} =	0,33	μs

Figure 10 half bridge FWD

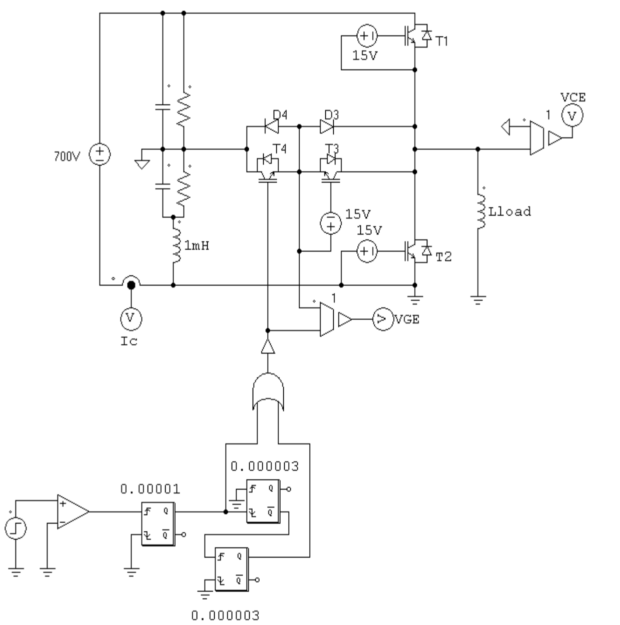
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	414,61	kW
E_{rec} (100%) =	14,30	mJ
t_{Erec} =	0,33	μs

neutral point IGBT switching measurement circuit

Figure 11

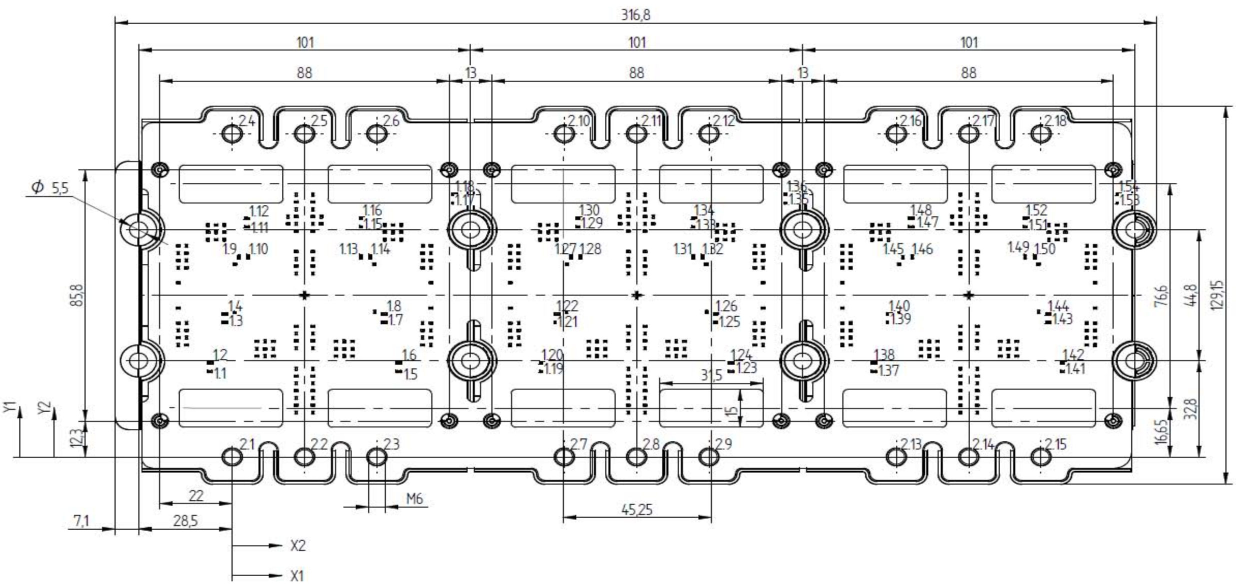


Ordering Code and Marking - Outline - Pinout

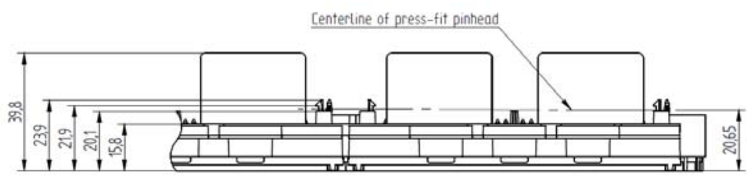
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard	70-W612M3A600SC-M200E	M200E	M200E

Outline



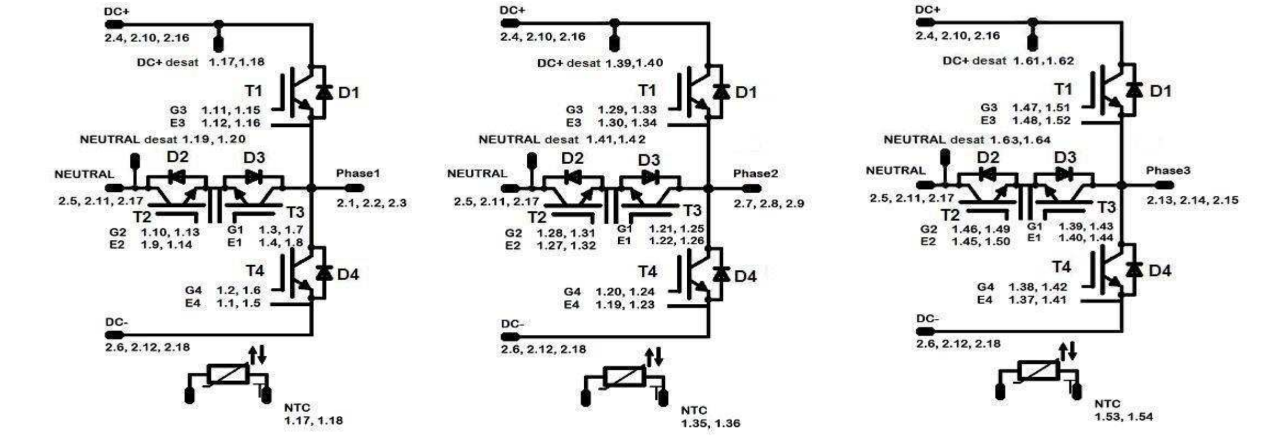
Pintable			Pintable		
Pin	X	Y	Pin	X	Y
1.1	-6,75	29,2	1.28	105,85	68,4
1.2	-6,75	32,1	1.29	105,5	78,65
1.3	-2,2	46	1.30	105,5	81,55
1.4	-2,2	48,9	1.31	140,15	68,4
1.5	50,75	29,2	1.32	143,05	68,4
1.6	50,75	32,1	1.33	140,5	78,65
1.7	46,2	46	1.34	140,5	81,55
1.8	46,2	48,9	1.35	168,65	86,7
1.9	1,95	68,4	1.36	168,65	89,8
1.10	4,85	68,4	1.37	195,25	29,2
1.11	4,5	78,65	1.38	195,25	32,1
1.12	4,5	81,55	1.39	199,8	46
1.13	39,15	68,4	1.40	199,8	48,9
1.14	42,05	68,4	1.41	252,75	29,2
1.15	39,5	78,65	1.42	252,75	32,1
1.16	39,5	81,55	1.43	248,2	46
1.17	67,65	86,7	1.44	248,2	48,9
1.18	67,65	89,8	1.45	203,95	68,4
1.19	94,25	29,2	1.46	206,85	68,4
1.20	94,25	32,1	1.47	206,5	78,65
1.21	98,8	46	1.48	206,5	81,55
1.22	98,8	48,9	1.49	241,15	68,4
1.23	151,75	29,2	1.50	244,05	68,4
1.24	151,75	32,1	1.51	241,5	78,65
1.25	147,2	46	1.52	241,5	81,55
1.26	147,2	48,9	1.53	269,65	86,7
1.27	102,95	68,4	1.54	269,65	89,8



Power connection table			Power connection table		
Pin	X	Y	Pin	X	Y
2.1	0	0	2.10	101	110,4
2.2	22	0	2.11	123	110,4
2.3	44	0	2.12	145	110,4
2.4	0	110,4	2.13	202	0
2.5	22	110,4	2.14	224	0
2.6	44	110,4	2.15	246	0
2.7	101	0	2.16	202	110,4
2.8	123	0	2.17	224	110,4
2.9	145	0	2.18	246	110,4

Ordering Code and Marking - Outline - Pinout

Pinout



Note: DC link and neutral pins are common for the 3 phases.

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