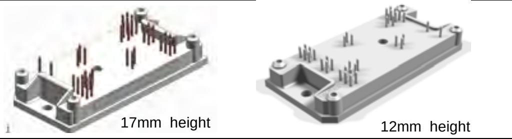
Vincotech

flowNPC 1	600V/100A

Features

- Neutral-point-Clamped inverter
- Compact flow1 housing
- Low Inductance Layout

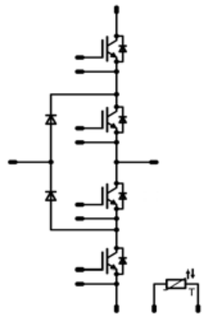
flow1 housing



Target Applications

- UPS
- Motor Drive
- Solar inverters

Schematic



Types

- 10-F106NIA100SA-M135F
- 10-P106NIA100SA-M135FY
- 10-FY06NIA100SA-M135F08

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Buck IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	$T_j=T_jmax$	T_h=80°C T_c=80°C	84 110	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax		300	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	136 206	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
Maximum Junction Temperature	T_jmax			175	°C
Turn off safe operating area		T_j≤150°C V_{CE}<=V_{CES}		200	A
Buck Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	$T_j=T_jmax$	T_h=80°C T_c=80°C	53 72	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_jmax	T_c=100°C	300	A
Power dissipation per Diode	P_{tot}	$T_j=T_jmax$	T_h=80°C T_c=80°C	70 106	W
Maximum Junction Temperature	T_jmax			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Boost IGBT					
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	80 104	A
Pulsed collector current	I_{Cpuls}	t_p limited by $T_j$max		300	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	126 192	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
Maximum Junction Temperature	$T_j$max			175	°C
Turn off safe operating area		T_j≤150°C V_{CE}<=V_{CES}		200	A
Boost Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_c=25°C		600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	74 98	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		200	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	107 162	W
Maximum Junction Temperature	$T_j$max			175	°C
Boost Diode					
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	75 100	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		200	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	110 166	W
Maximum Junction Temperature	$T_j$max			175	°C
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

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	
Buck IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0016	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	Tj=25°C Tj=150°C	1,05	1,50 1,73	1,85	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			60	µA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			1,4	µA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$					Tj=25°C Tj=150°C		160 189		
Rise time	t_r					Tj=25°C Tj=150°C		26 31		ns
Turn-off delay time	$t_{d(off)}$	Rgon=8 Ω Rgoff=8 Ω	±15	350	100	Tj=25°C Tj=150°C		270 296		
Fall time	t_f					Tj=25°C Tj=150°C		100 123		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,887 2,405		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		2,903 3,808		
Input capacitance	C_{ies}							6280		
Output capacitance	C_{oss}	f=1MHz	0	25		Tj=25°C		400		pF
Reverse transfer capacitance	C_{rss}							186		
Gate charge	Q_{Gate}		15	480	100	Tj=25°C		620		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,81 W/mK						0,699		K/W
Buck Diode										
Diode forward voltage	V_F				100	Tj=25°C Tj=150°C	1,4	1,70 1,71	1,9	V
Peak reverse recovery current	I_{RRM}					Tj=25°C Tj=150°C		86 113		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		127 164		ns
Reverse recovered charge	Q_{rr}	Rgon=8 Ω	±15	350	100	Tj=25°C Tj=150°C		5,072 9,357		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		3385 1871		A/µs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		1,154 2,238		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,81 W/mK						1,360		K/W

Note: All characteristic values are related to gates of paralell IGBTs connected together

Characteristic Values

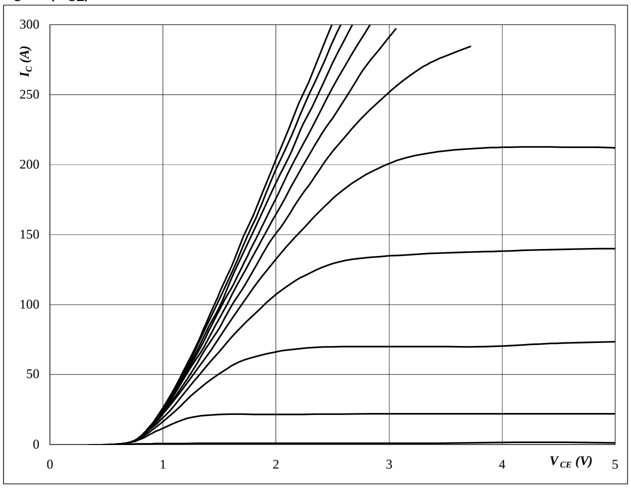
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0016	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	Tj=25°C Tj=150°C	1,05	1,5 1,73	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25°C Tj=150°C			60	µA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			1,4	µA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgon=8 Ω Rgoff=8 Ω				Tj=25°C Tj=150°C		164 169		ns
Rise time	t_r					Tj=25°C Tj=150°C		29 32		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		273 298		
Fall time	t_f					Tj=25°C Tj=150°C		97 116		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,93 2,55		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		3,22 4,27		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		6280		pF
Output capacitance	C_{oss}							400		
Reverse transfer capacitance	C_{rss}							186		
Gate charge	Q_{Gate}		15	480	100	Tj=25°C		620		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,81 W/mK						0,751		K/W
Boost Inverse Diode										
Diode forward voltage	V_F				100	Tj=25°C Tj=125°C	1,2	1,69 1,65	1,9	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,81 W/mK						0,867		K/W
Boost Diode										
Diode forward voltage	V_F				100	Tj=25°C Tj=150°C	1,2	1,68 1,65	1,9	V
Reverse leakage current	I_r			600		Tj=25°C Tj=150°C			60	µA
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	350	100	Tj=25°C Tj=150°C		71 90		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		130 287		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		4,4 9,3		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		2960 551		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C		1,03 2,37		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 0,81 W/mK						0,867		K/W
Thermistor										
Rated resistance	R					T=25°C		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=100°C	-5		5	%
Power dissipation	P					T=25°C		200		mW
Power dissipation constant						T=25°C		2		mW/K
B-value	B(25/50)	Tol. ±3%				T=25°C		3950		K
B-value	B(25/100)	Tol. ±3%				T=25°C		3996		K
Vincotech NTC Reference									B	

Buck

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



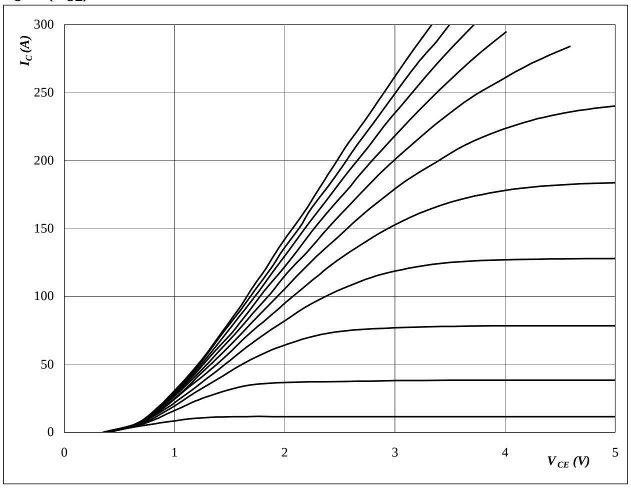
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



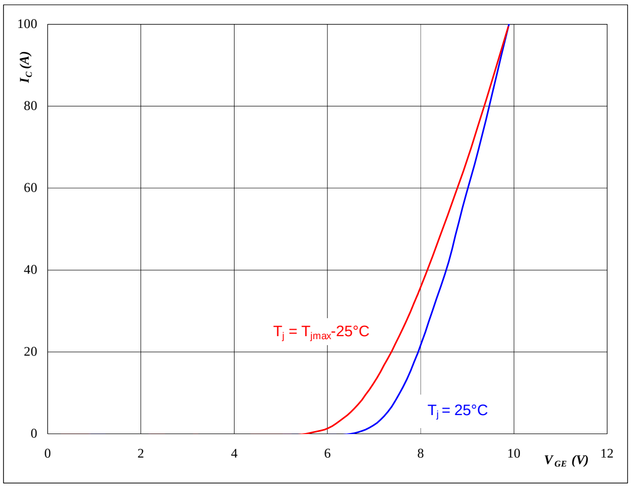
At

t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



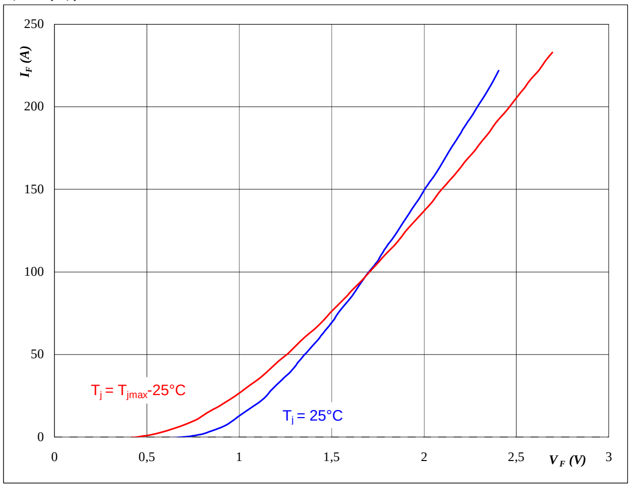
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

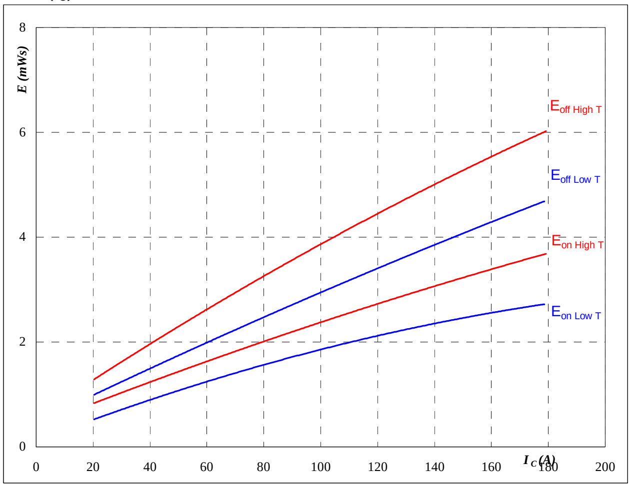
t_p =	250	µs

Buck

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



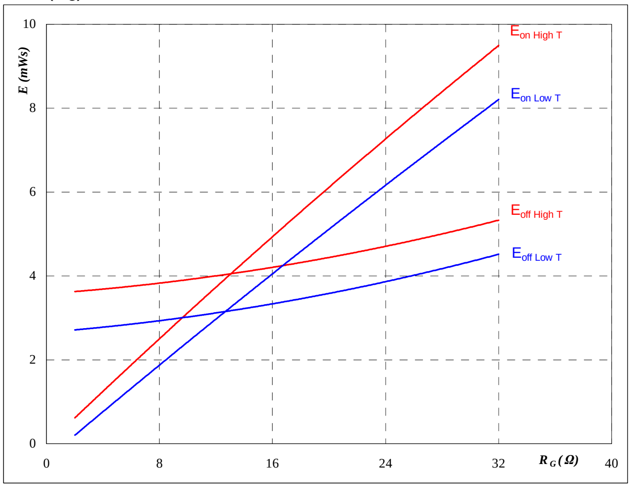
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



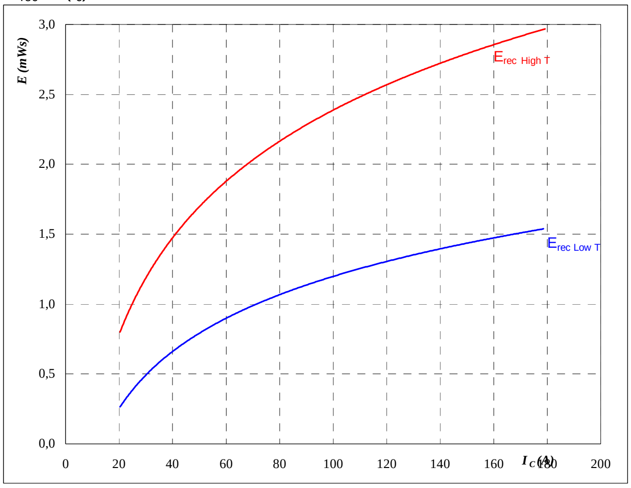
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	100	A

Figure 7 FRED

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_c)



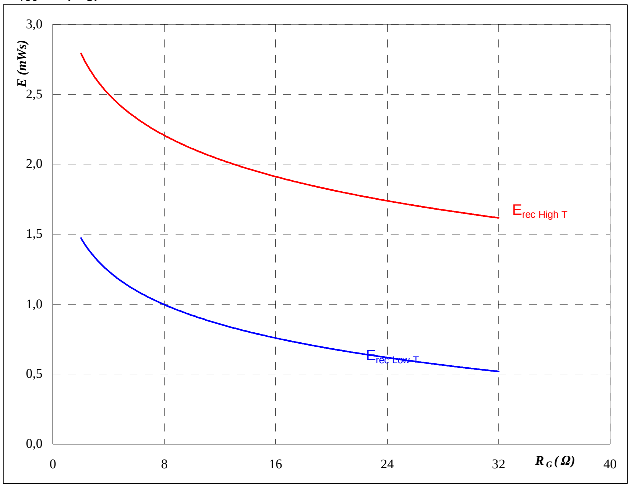
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 8 FRED

Typical reverse recovery energy loss
as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

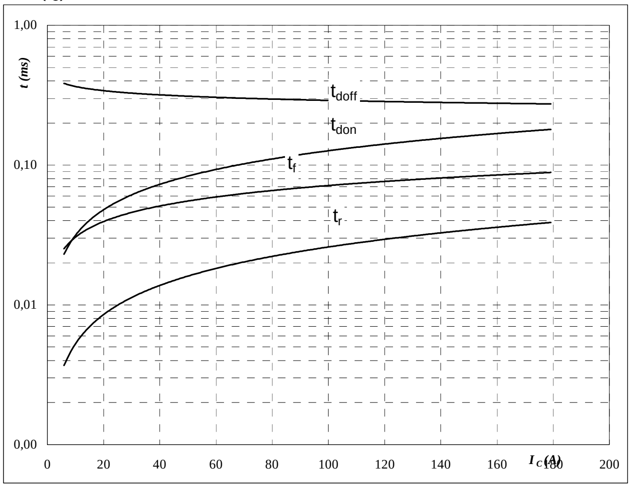
T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	100	A

Buck

Figure 9 IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



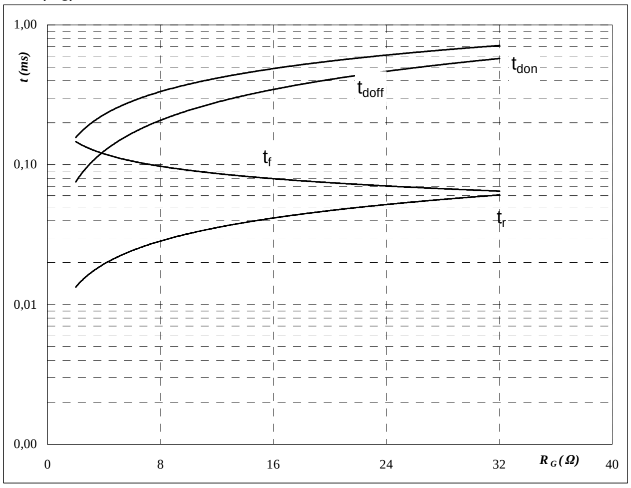
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



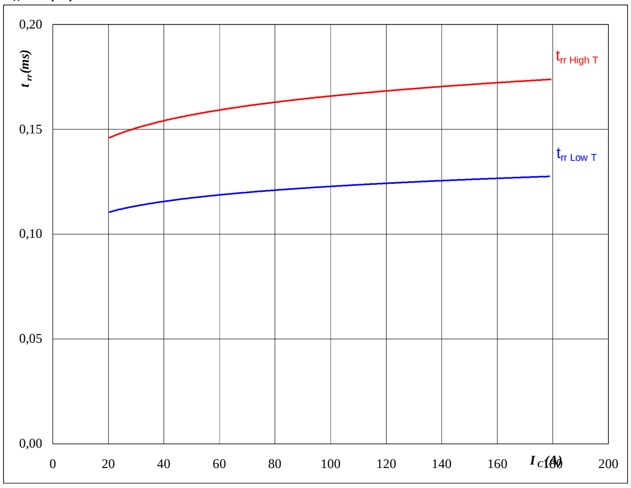
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	100	A

Figure 11 FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



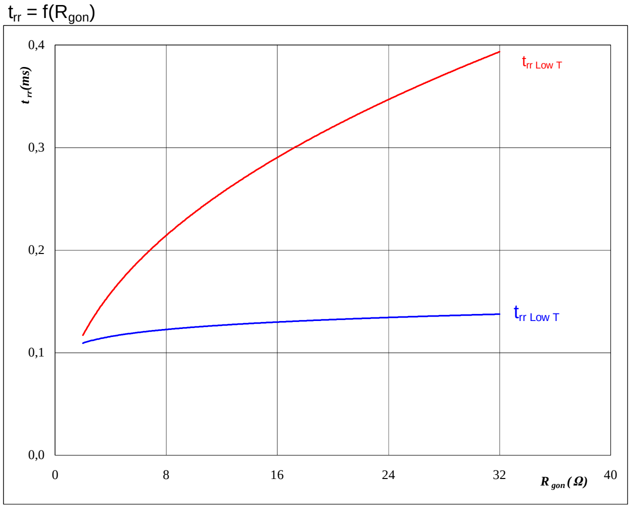
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 FRED

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

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



At

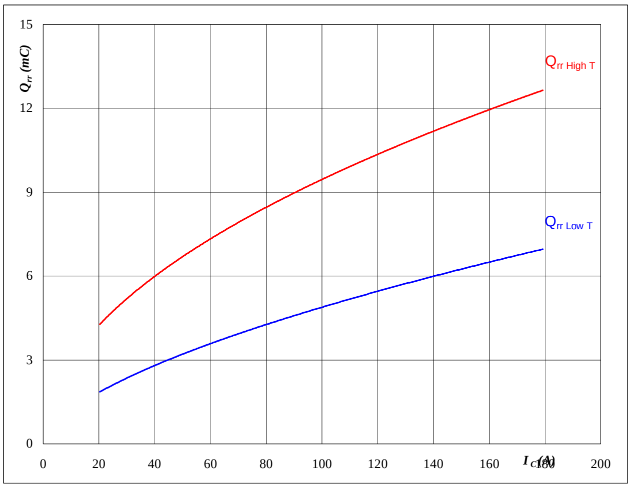
T_j =	25/150	°C
V_R =	350	V
I_F =	100	A
V_{GE} =	±15	V

Buck

Figure 13 FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



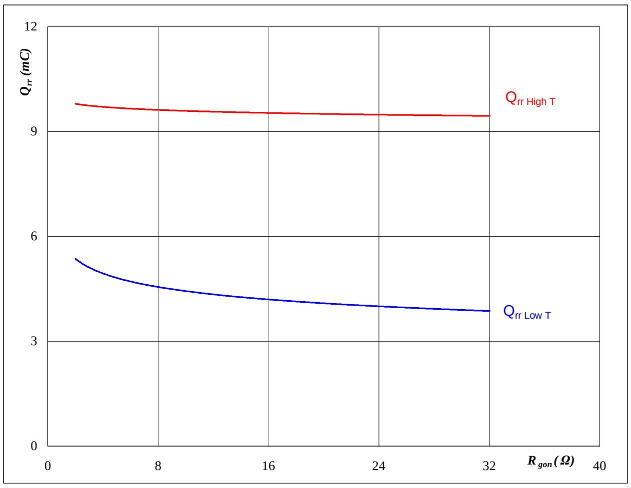
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 FRED

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

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



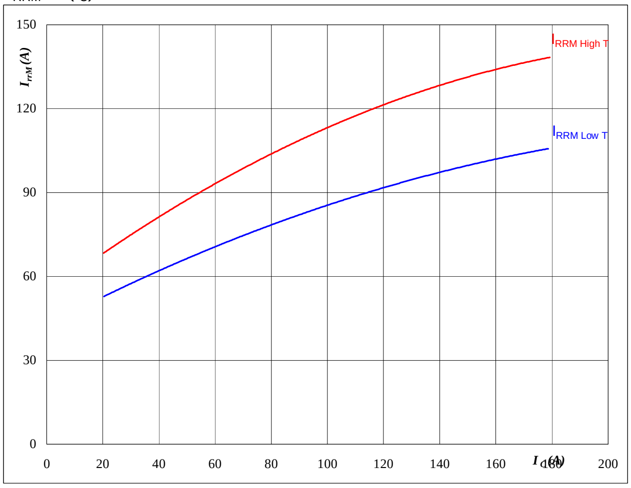
At

T_j =	25/150	°C
V_R =	350	V
I_F =	100	A
V_{GE} =	±15	V

Figure 15 FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



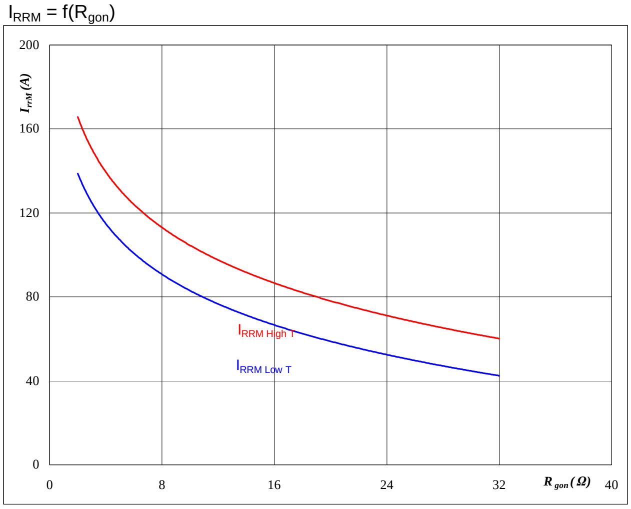
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 FRED

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

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



At

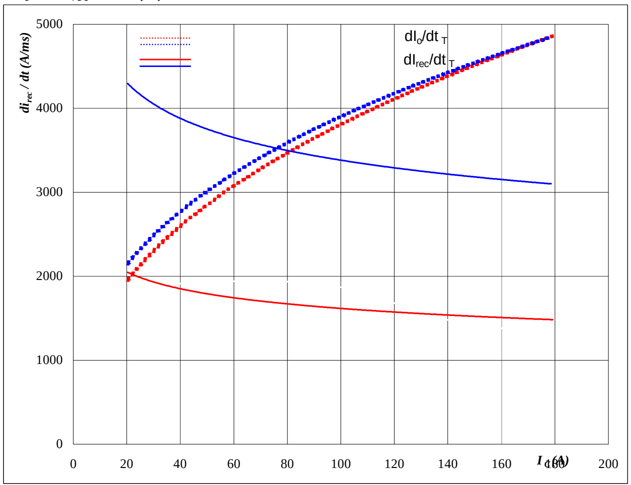
T_j =	25/150	°C
V_R =	350	V
I_F =	100	A
V_{GE} =	±15	V

Buck

Figure 17 FRED

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

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



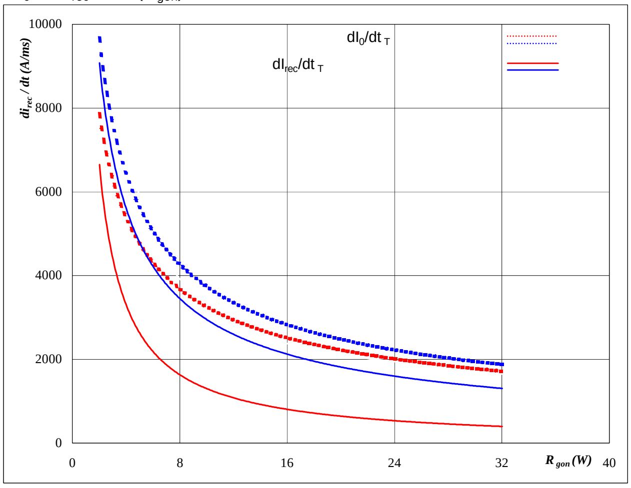
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18 FRED

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

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



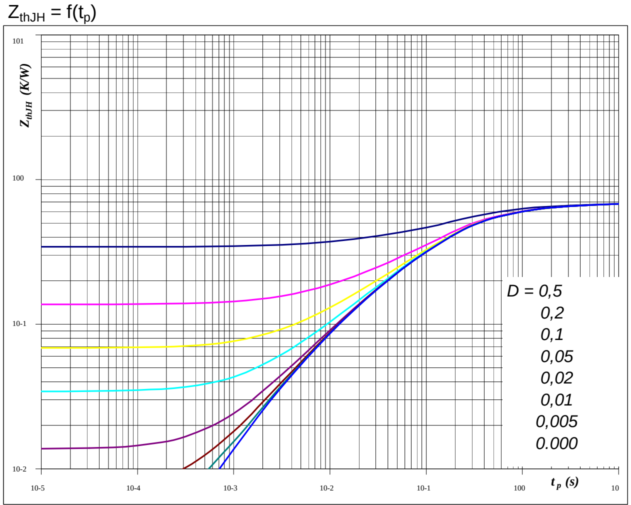
At

T_j =	25/150	°C
V_R =	350	V
I_F =	100	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} =	0,699	K/W

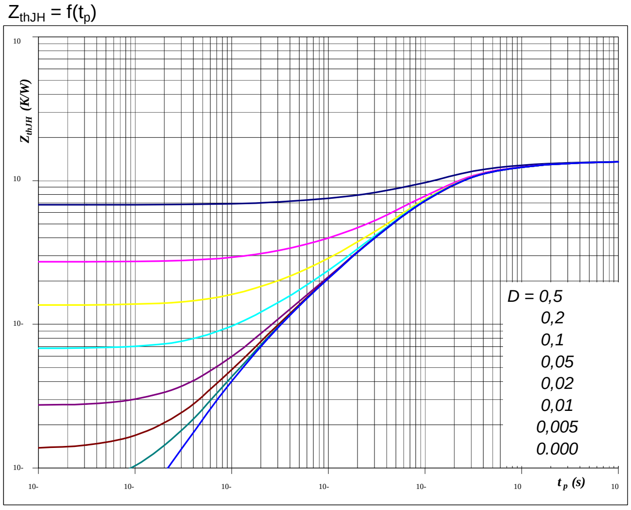
IGBT thermal model values

R (C/W)	Tau (s)
0,05	4,4E+00
0,12	9,5E-01
0,32	2,0E-01
0,12	6,2E-02
0,07	1,4E-02
0,02	2,8E-03

Figure 20 FRED

FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	1,359	K/W

FRED thermal model values

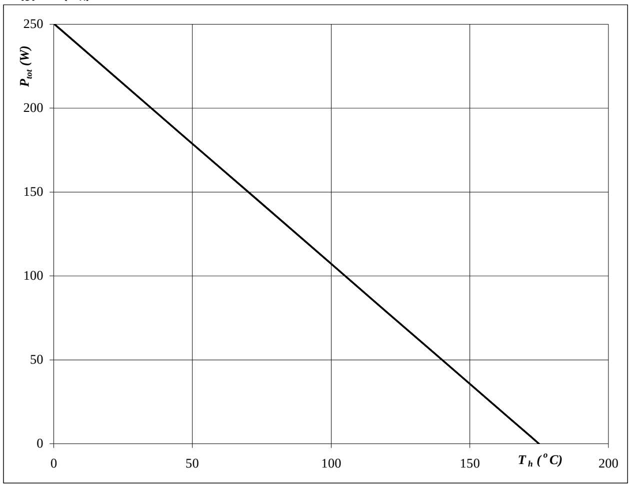
R (C/W)	Tau (s)
0,07	4,4E+00
0,19	8,7E-01
0,62	1,7E-01
0,31	5,7E-02
0,13	1,1E-02
0,04	1,6E-03

Buck

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



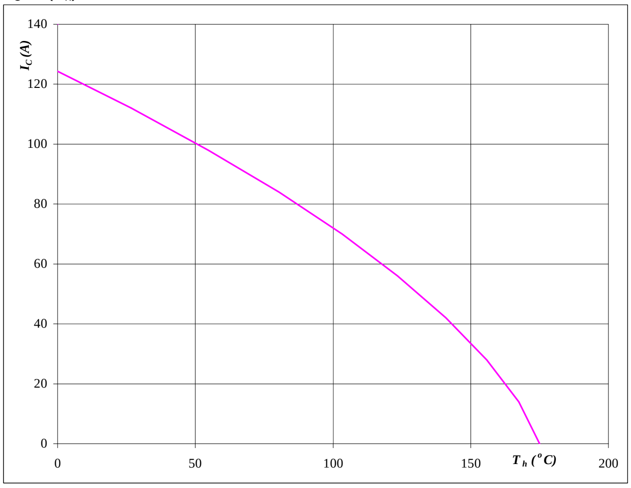
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

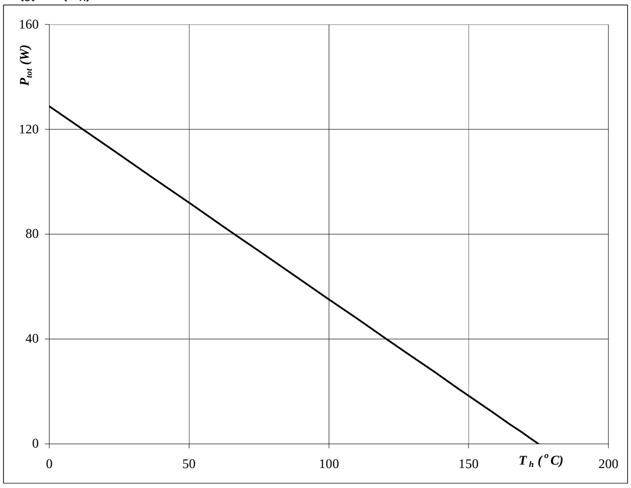
T_j = 175 °C

V_{GE} = 15 V

Figure 23 FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



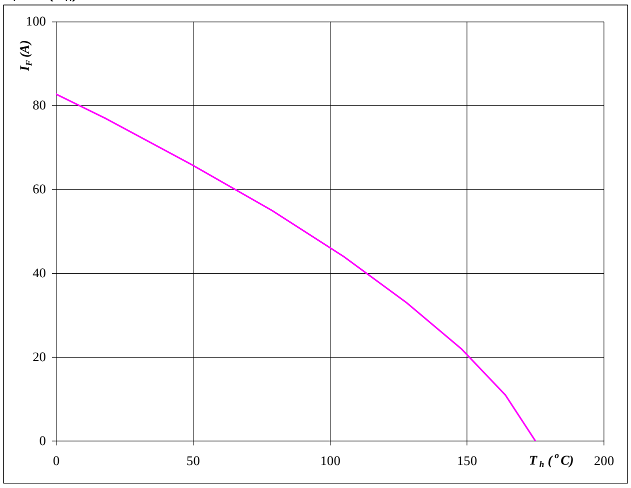
At

T_j = 175 °C

Figure 24 FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

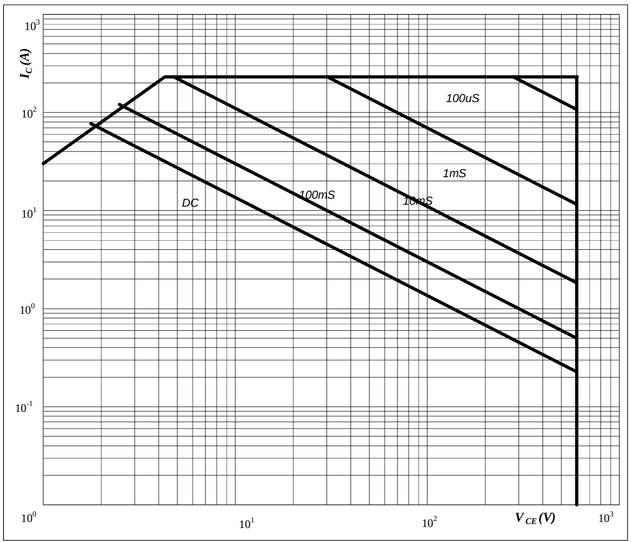
T_j = 175 °C

Buck

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



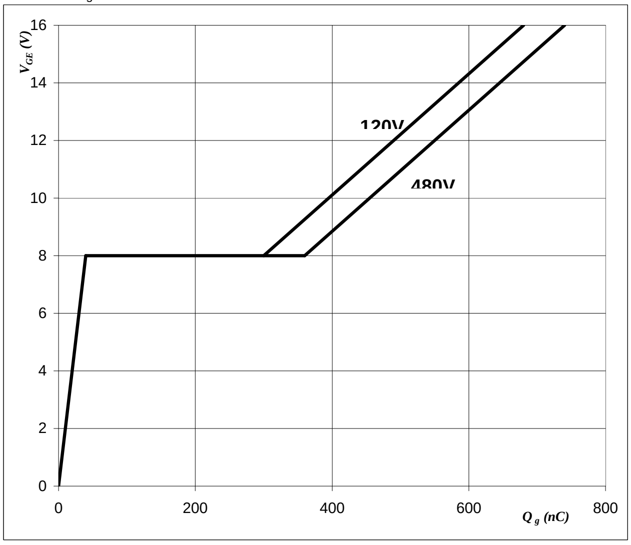
At

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

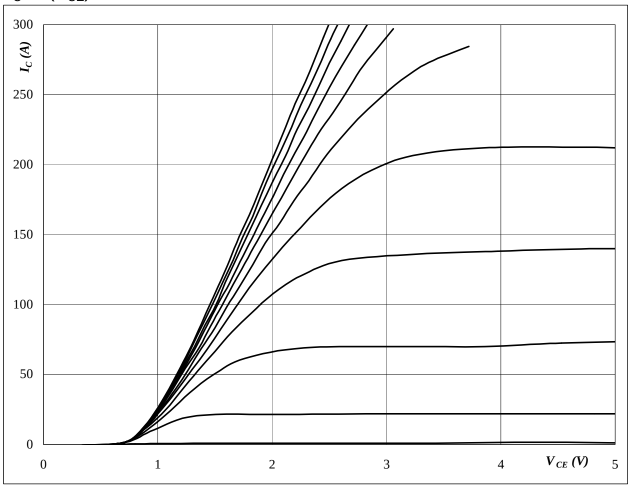
I_C =	100	A

Boost

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



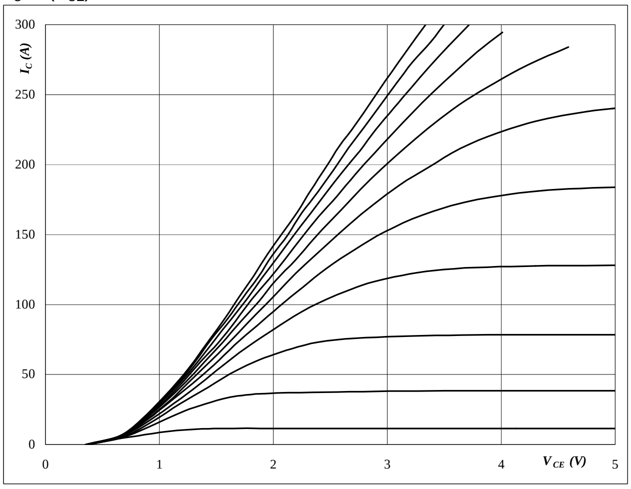
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



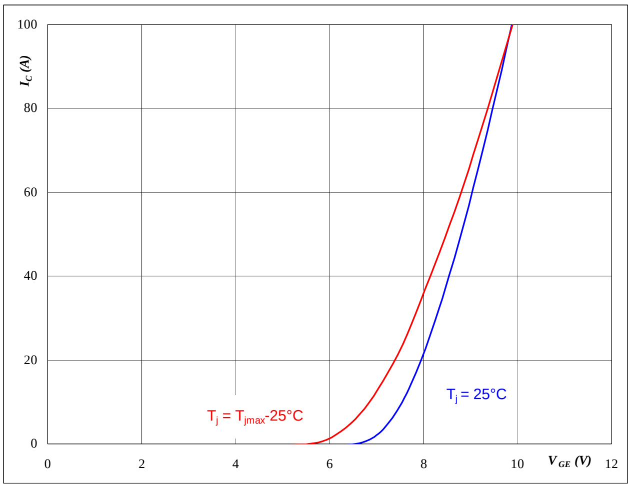
At

t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



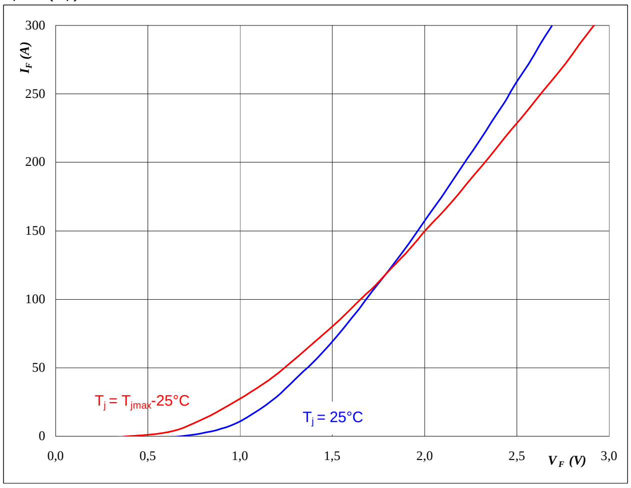
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

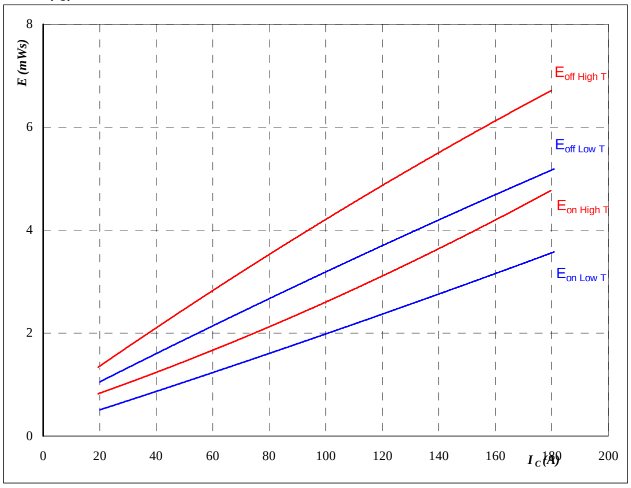
t_p =	250	µs

Boost

Figure 5 IGBT

Typical switching energy losses as a function of collector current

E = f(I_C)



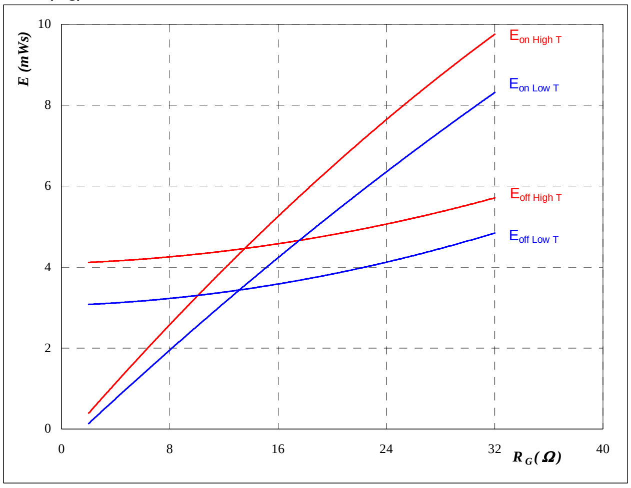
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_G)



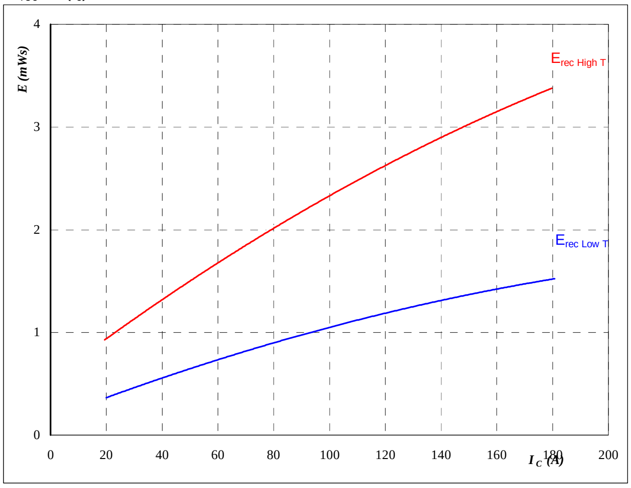
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	101	A

Figure 7 IGBT

Typical reverse recovery energy loss as a function of collector current

E_{rec} = f(I_c)



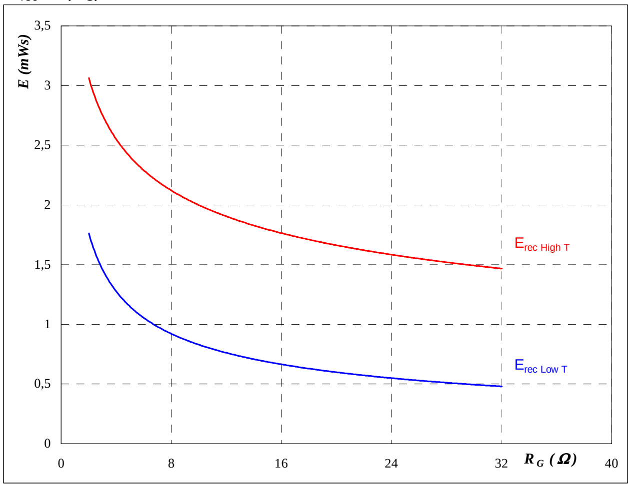
With an inductive load at

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 8 IGBT

Typical reverse recovery energy loss as a function of gate resistor

E_{rec} = f(R_G)



With an inductive load at

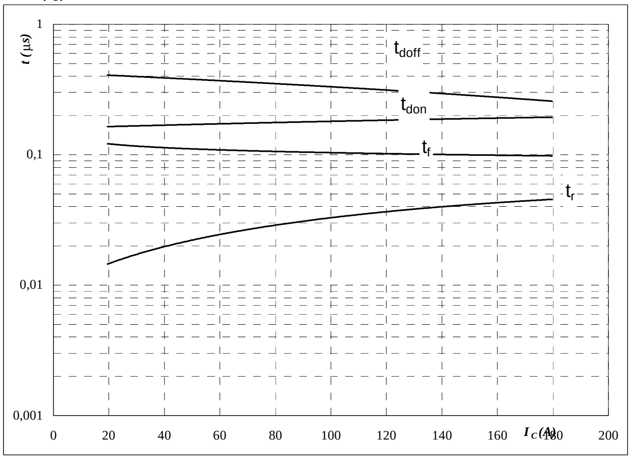
T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	101	A

Boost

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



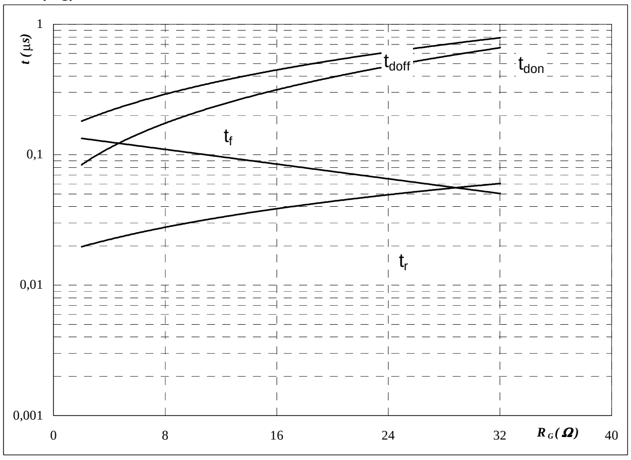
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



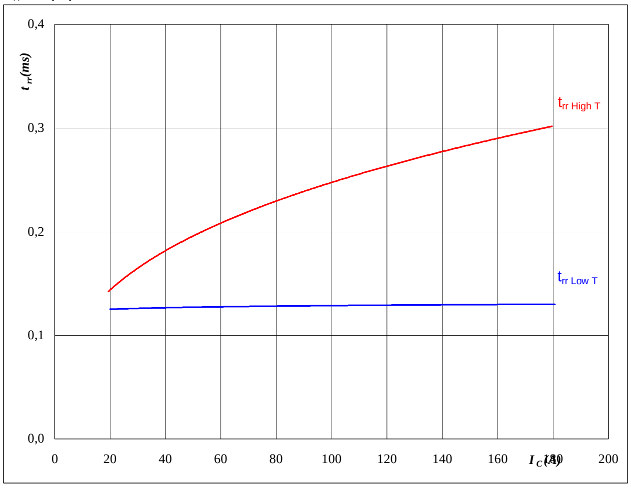
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	101	A

Figure 11 FRED

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



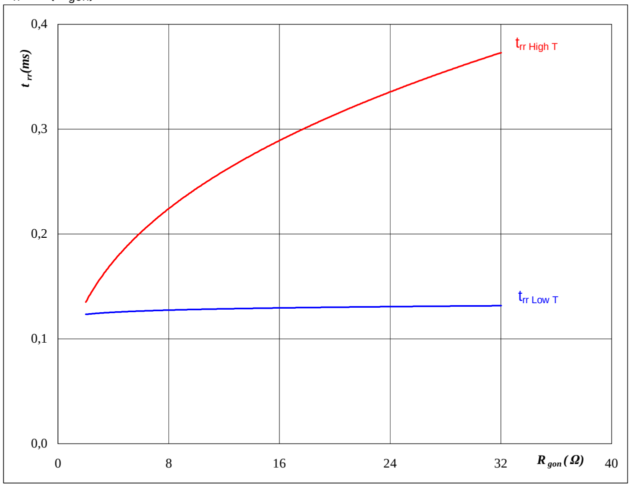
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 FRED

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

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



At

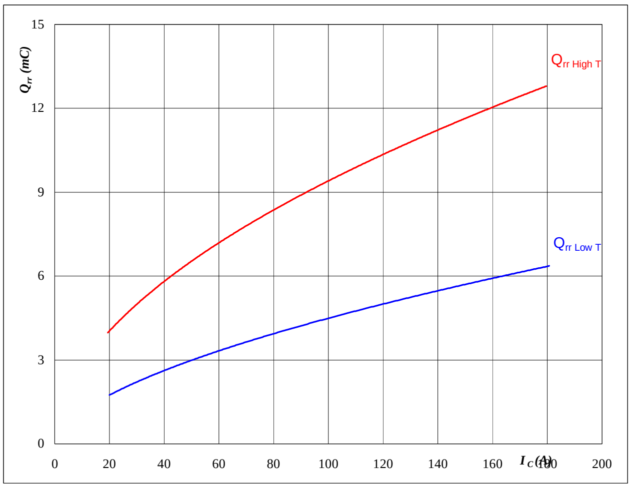
T_j =	25/150	°C
V_R =	350	V
I_F =	101	A
V_{GE} =	±15	V

Boost

Figure 13 FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



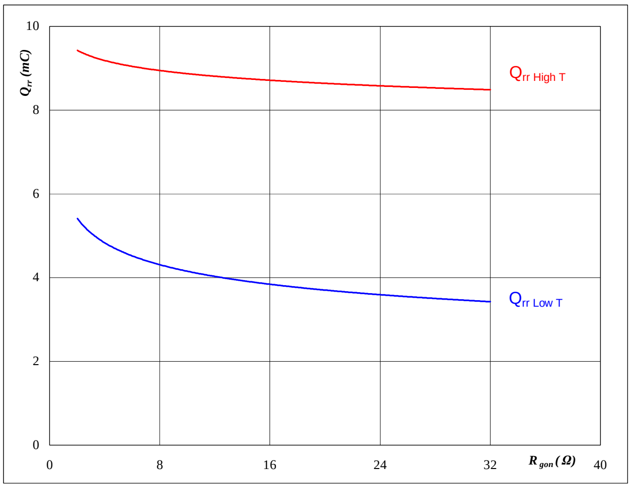
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 FRED

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

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



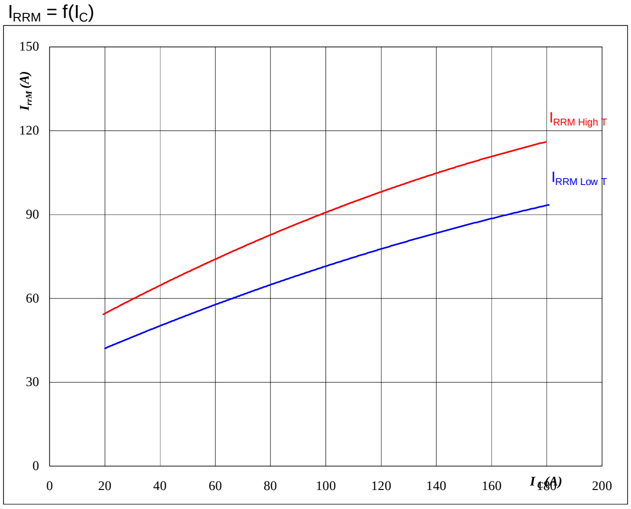
At

T_j =	25/150	°C
V_R =	350	V
I_F =	101	A
V_{GE} =	±15	V

Figure 15 FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



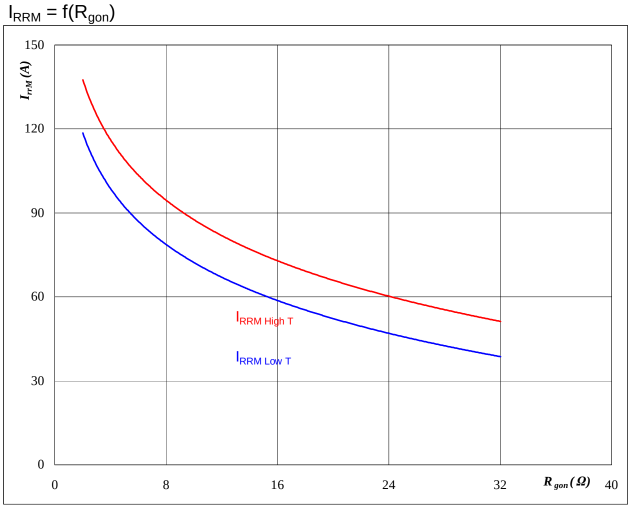
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 FRED

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

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



At

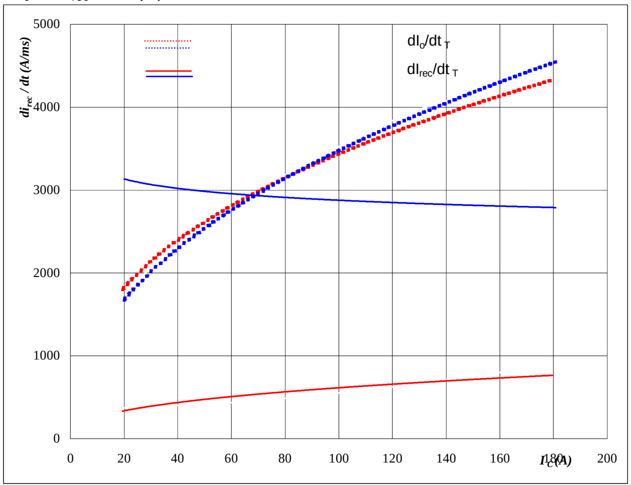
T_j =	25/150	°C
V_R =	350	V
I_F =	101	A
V_{GE} =	±15	V

Boost

Figure 17	FRED

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

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



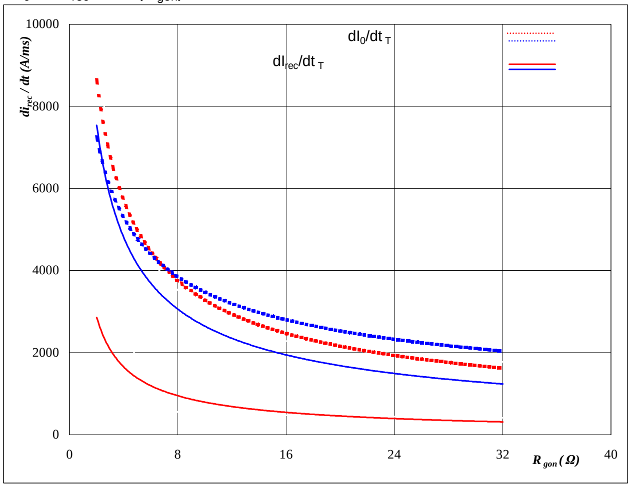
At

T_j =	25/150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18	FRED

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

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



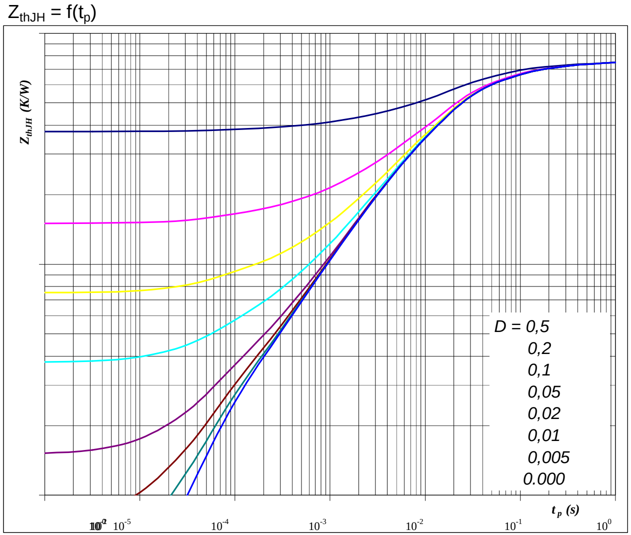
At

T_j =	25/150	°C
V_R =	350	V
I_F =	101	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} =	0,751	K/W

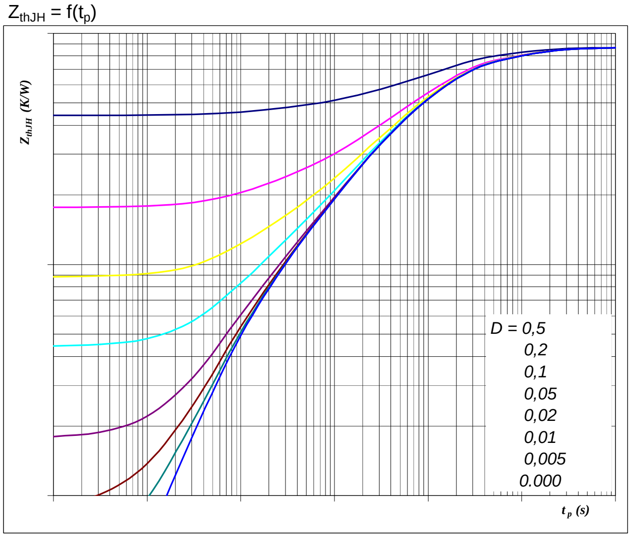
IGBT thermal model values

R (C/W)	Tau (s)
0,08	3,1E+00
0,12	7,5E-01
0,37	1,8E-01
0,11	3,8E-02
0,05	8,2E-03
0,02	8,3E-04

Figure 20	FRED

FRED transient thermal impedance
as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	0,867	K/W

FRED thermal model values

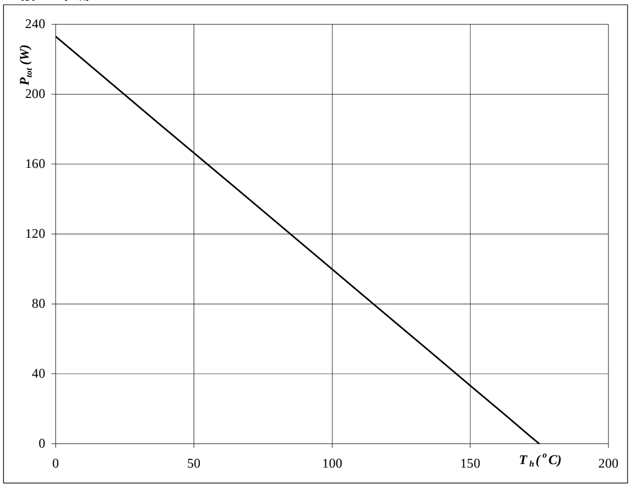
R (C/W)	Tau (s)
0,05	4,8E+00
0,13	8,5E-01
0,34	1,5E-01
0,18	3,9E-02
0,11	9,0E-03
0,05	1,1E-03

Boost

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

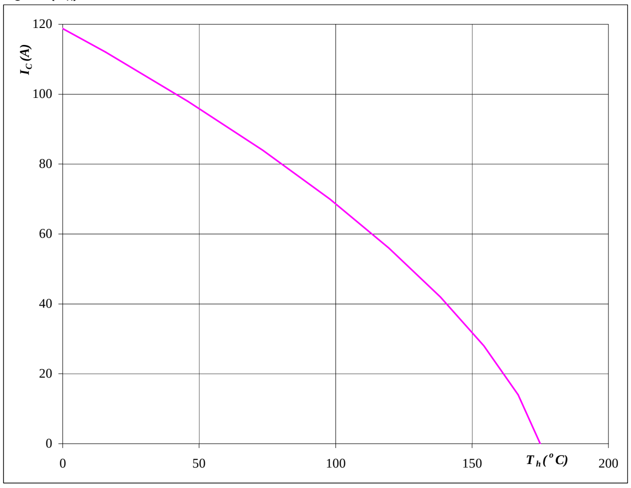


At
T_j = 175 ºC

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$

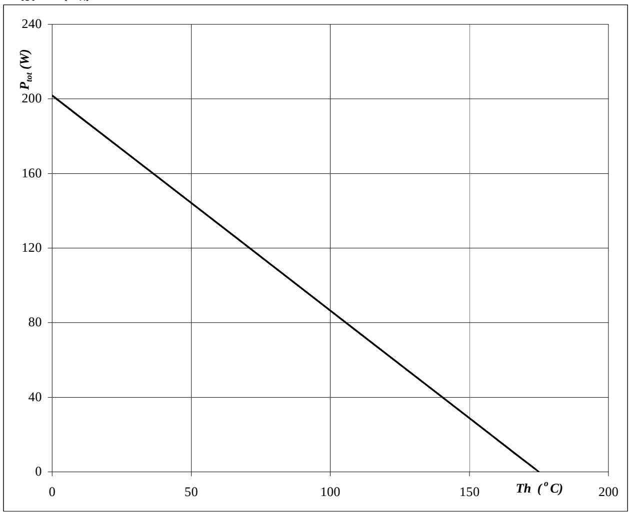


At
T_j = 175 ºC
V_{GE} = 15 V

Figure 23 FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$

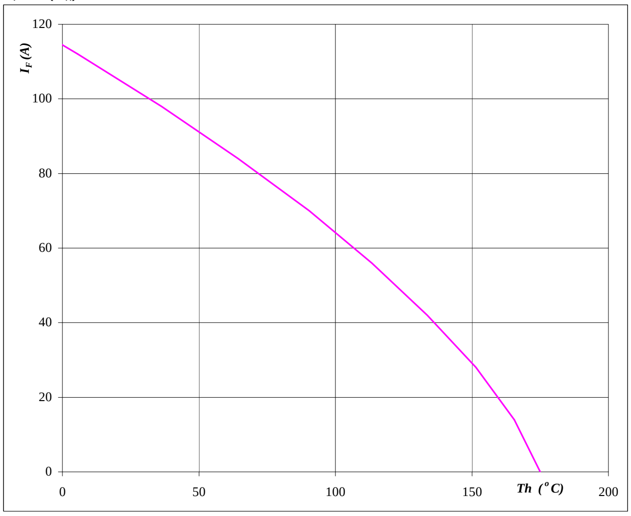


At
T_j = 175 ºC

Figure 24 FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



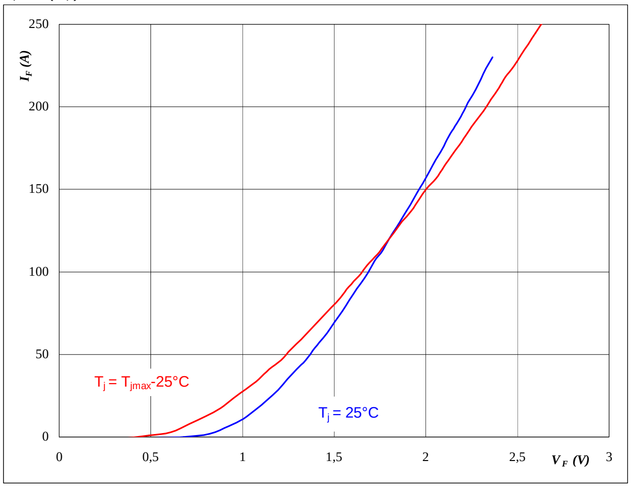
At
T_j = 175 ºC

Boost

Figure 25 Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



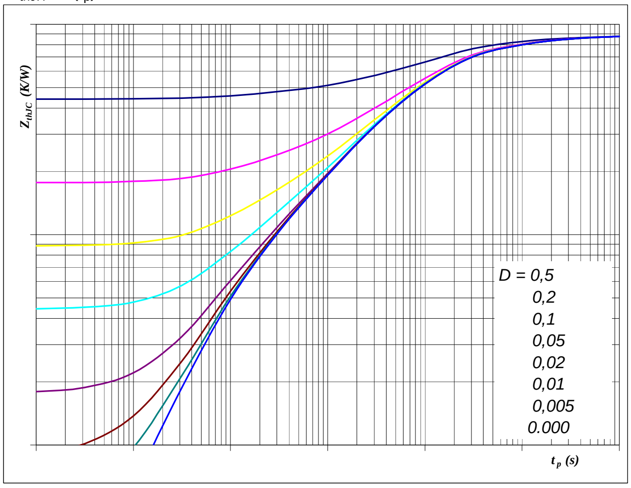
At

t_p = 250 µs

Figure 26 Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

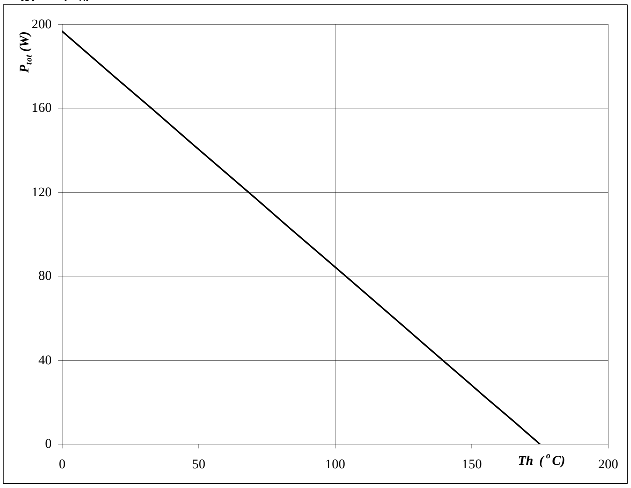
D = tp / T

R_{thJH} = 0,890 K/W

Figure 27 Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



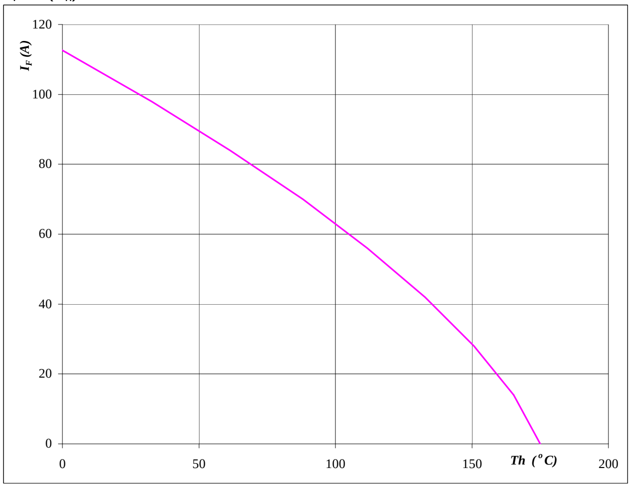
At

T_j = 175 ºC

Figure 28 Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 175 ºC

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$

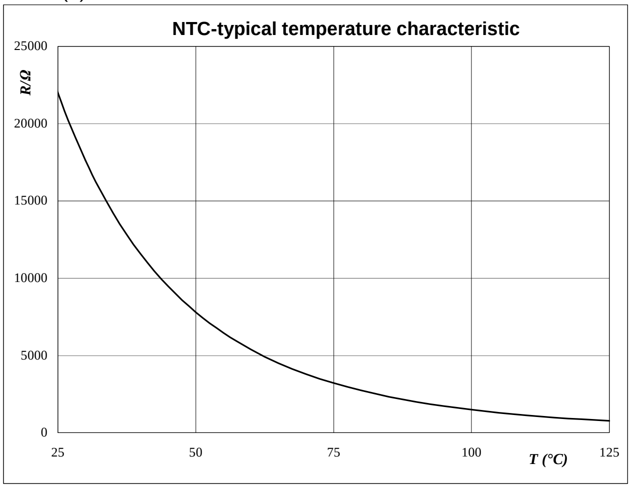


Figure 2 Thermistor

Typical NTC resistance values

$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

T [°C]	R [Ω]		T [°C]	R [Ω]
-55	3006477		30	17635
-50	1993973		40	11574
-45	1346473		50	7796
-40	924676		55	6457
-35	645112		60	5378
-30	456784		65	4503
-25	327965		70	3791
-20	238577		75	3207
-15	175705		80	2726
-10	130914		85	2327
-5	98618		90	1996
0	75063		95	1718
5	57698		100	1486
10	44764		105	1289
15	35037		110	1123
20	27654		115	982
25	22000		120	861
30	17635		125	758

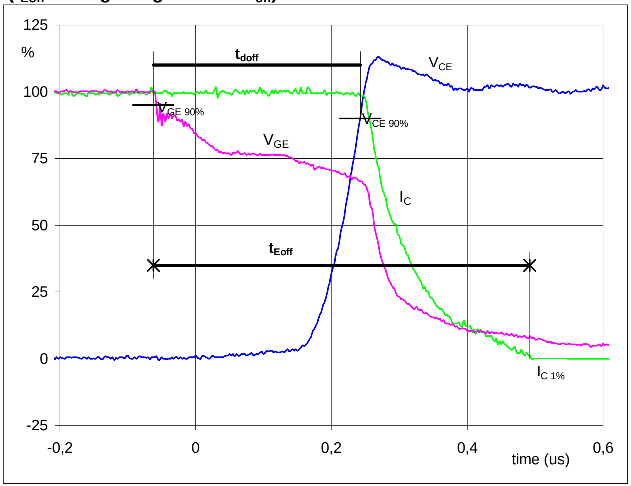
Switching Definitions BUCK IGBT

General conditions

T_j	=	150 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Output inverter IGBT

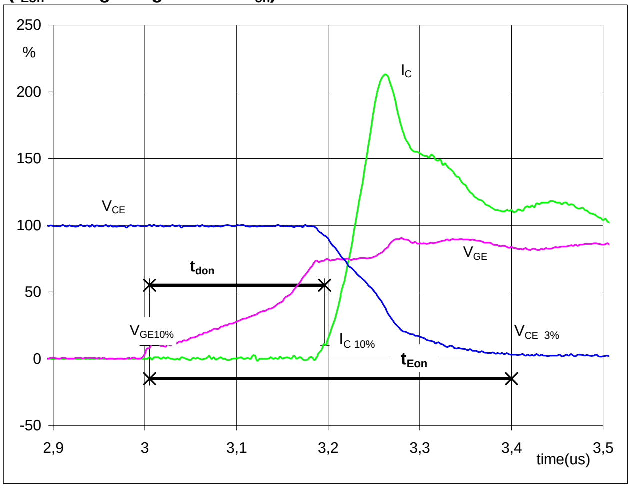
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
t_{doff} =	0,30	µs
t_{Eoff} =	0,55	µs

Figure 2 Output inverter IGBT

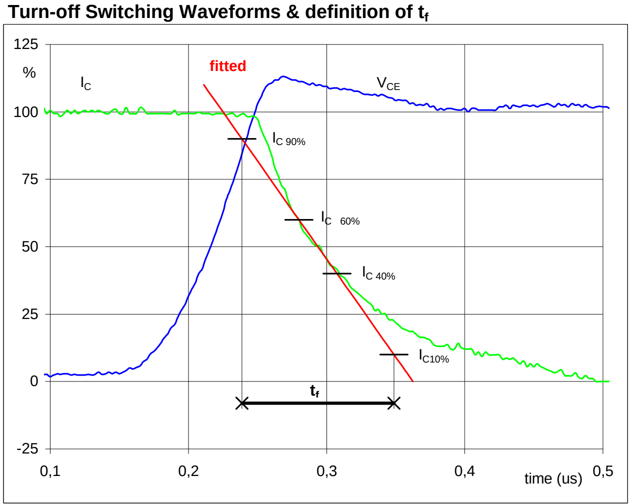
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
t_{don} =	0,19	µs
t_{Eon} =	0,39	µs

Figure 3 Output inverter IGBT

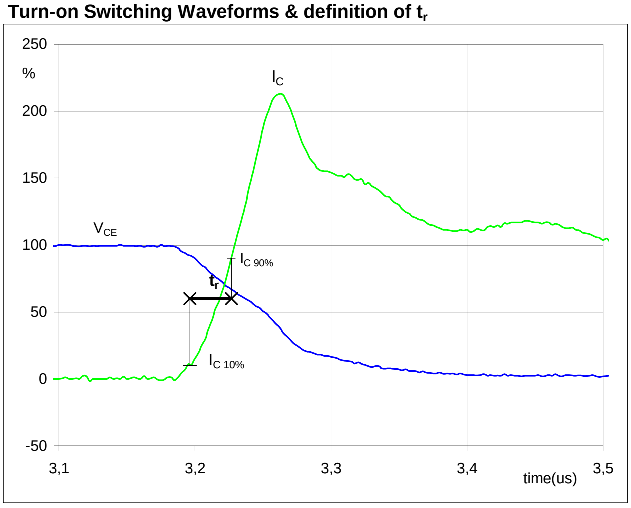
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	100	A
t_f =	0,12	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

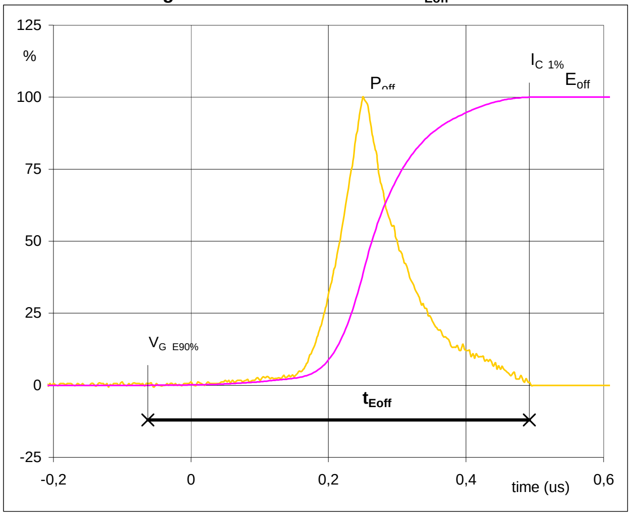


V_C (100%) =	350	V
I_C (100%) =	100	A
t_r =	0,03	µs

Switching Definitions BUCK IGBT

Figure 5 Output inverter IGBT

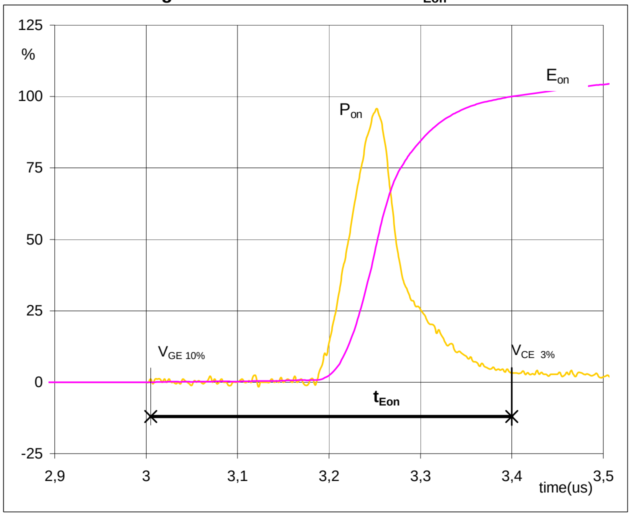
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	34,85	kW
E_{off} (100%) =	3,81	mJ
t_{Eoff} =	0,55	μs

Figure 6 Output inverter IGBT

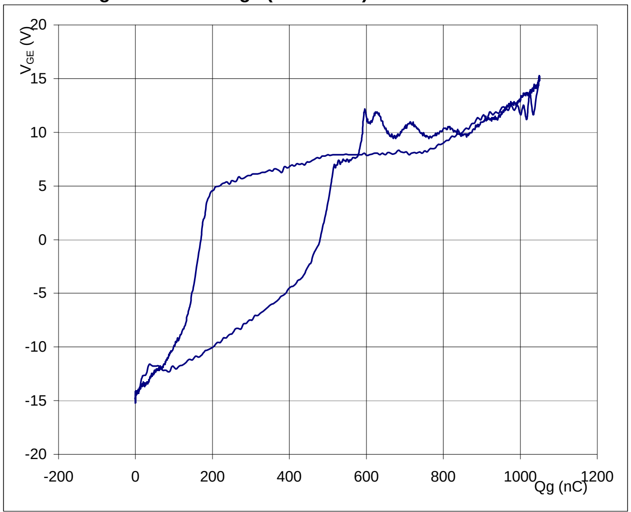
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	34,85	kW
E_{on} (100%) =	2,41	mJ
t_{Eon} =	0,39	μs

Figure 7 Output inverter FRED

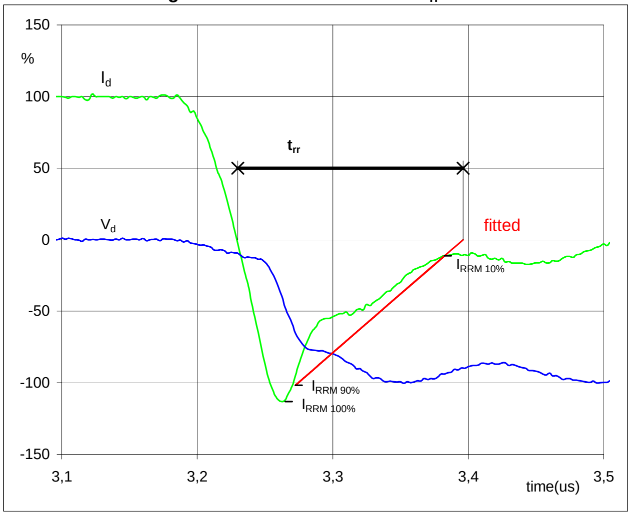
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
Q_g =	1049,61	nC

Figure 8 Output inverter IGBT

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

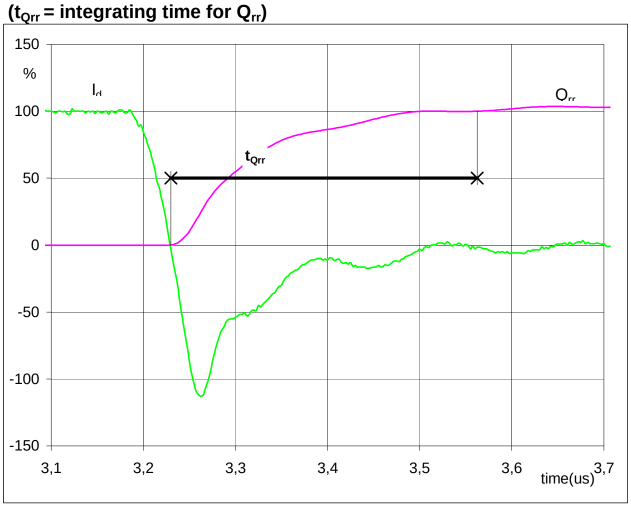


V_d (100%) =	350	V
I_d (100%) =	100	A
I_{RRM} (100%) =	-113	A
t_{rr} =	0,16	μs

Switching Definitions BUCK IGBT

Figure 9 Output inverter FRED

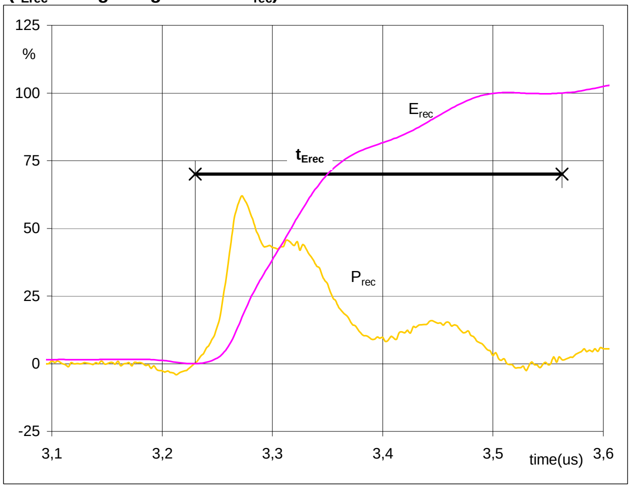
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	100	A
Q_{rr} (100%) =	9,36	µC
t_{Qrr} =	0,33	µs

Figure 10 Output inverter FRED

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

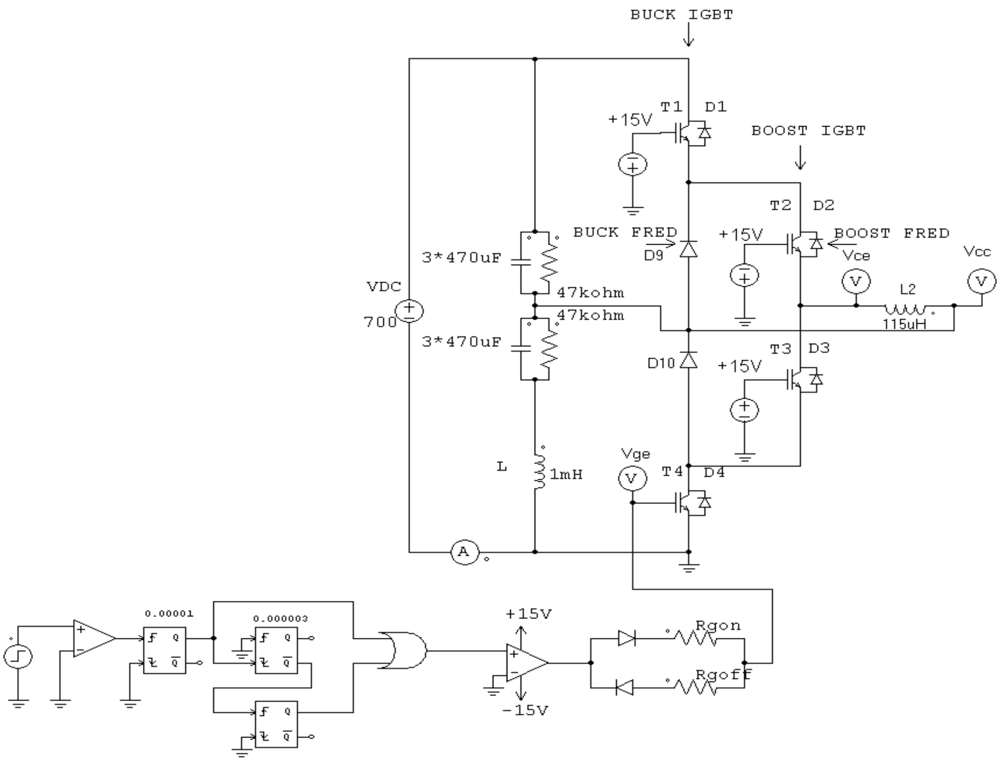


P_{rec} (100%) =	34,85	kW
E_{rec} (100%) =	2,24	mJ
t_{Erec} =	0,33	µs

Measurement circuit

Figure 11

BUCK stage switching measurement circuit



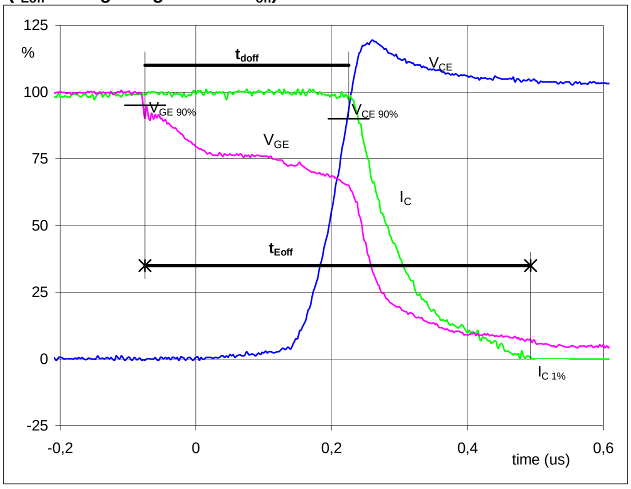
Switching Definitions Reactiv

General conditions

T_j	=	150 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 Output inverter IGBT

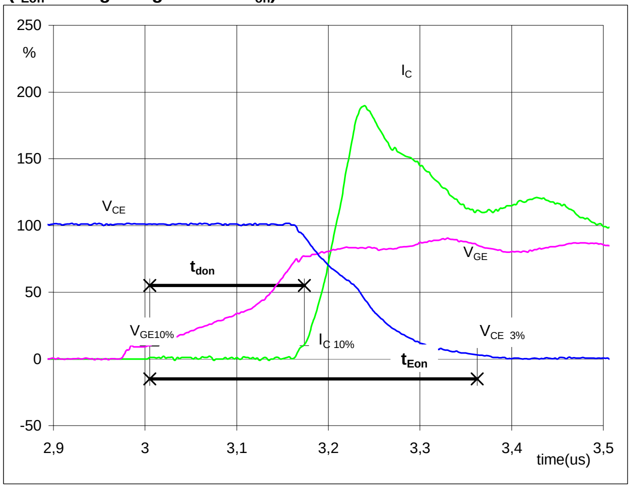
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
t_{doff} =	0,30	μs
t_{Eoff} =	0,57	μs

Figure 2 Output inverter IGBT

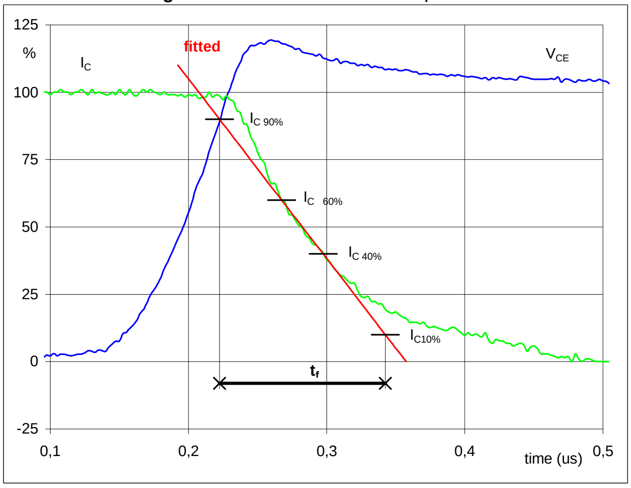
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
t_{don} =	0,17	μs
t_{Eon} =	0,36	μs

Figure 3 Output inverter IGBT

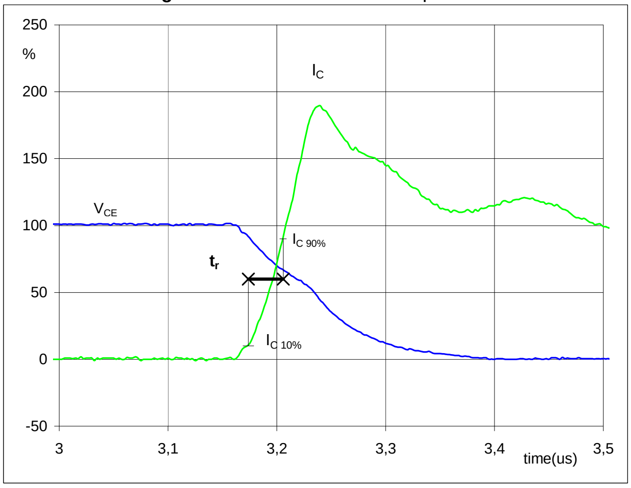
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	100	A
t_f =	0,12	μs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

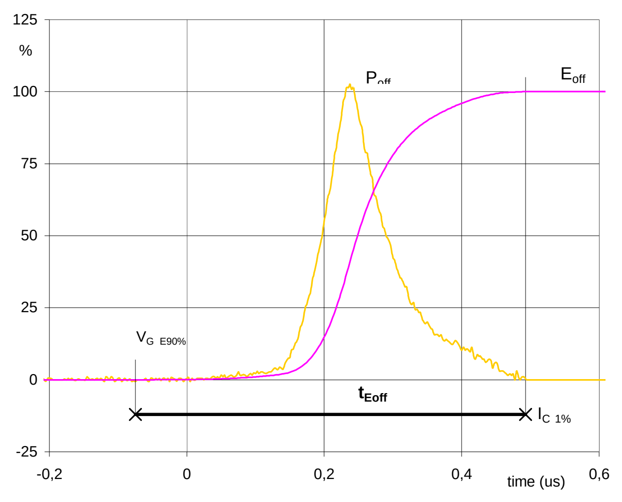


V_C (100%) =	350	V
I_C (100%) =	100	A
t_r =	0,03	μs

Switching Definitions Reactiv

Figure 5 — Output inverter IGBT

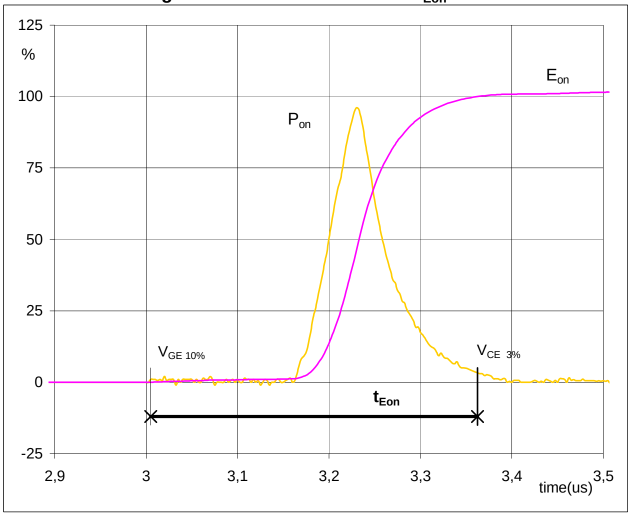
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	35,15	kW
E_{off} (100%) =	4,27	mJ
t_{Eoff} =	0,57	μs

Figure 6 — Output inverter IGBT

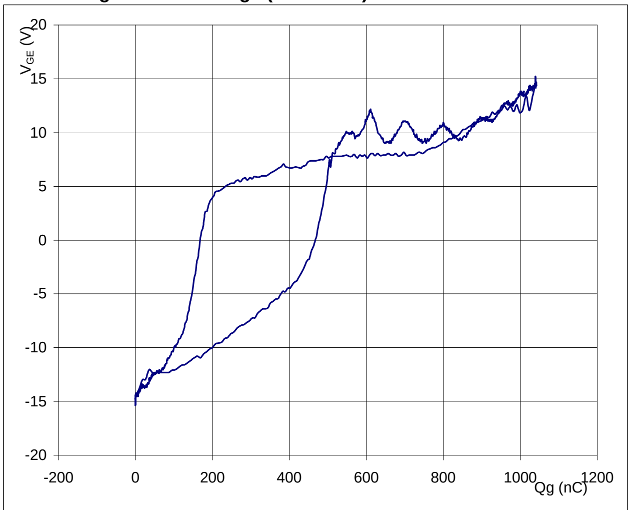
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	35,15	kW
E_{on} (100%) =	2,55	mJ
t_{Eon} =	0,36	μs

Figure 7 — Output inverter FRED

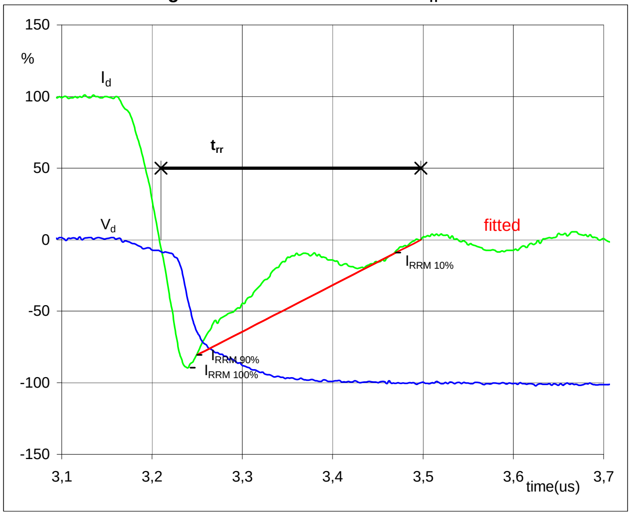
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	350	V
I_C (100%) =	100	A
Q_g =	1042,08	nC

Figure 8 — Output inverter IGBT

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

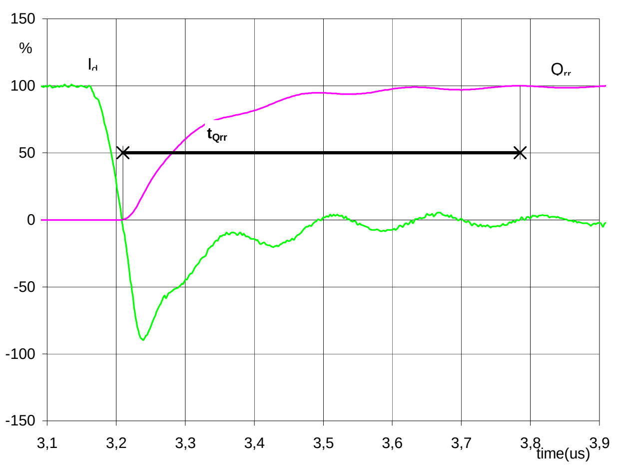


V_d (100%) =	350	V
I_d (100%) =	100	A
I_{RRM} (100%) =	-90	A
t_{rr} =	0,29	μs

Switching Definitions Reactiv

Figure 9 Output inverter FRED

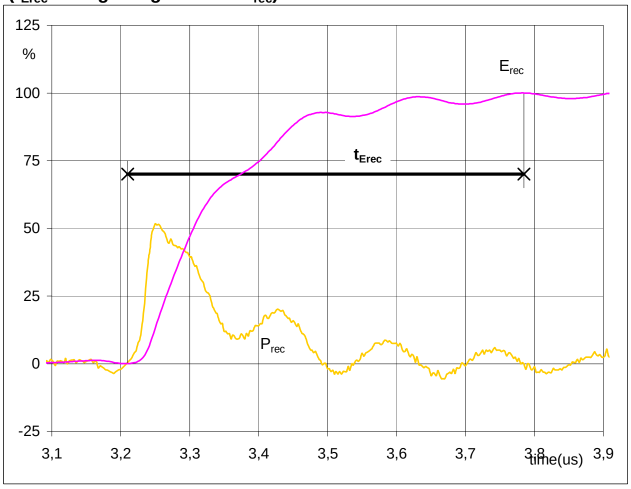
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	100	A
Q_{rr} (100%) =	9,27	µC
t_{Qrr} =	0,57	µs

Figure 10 Output inverter FRED

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

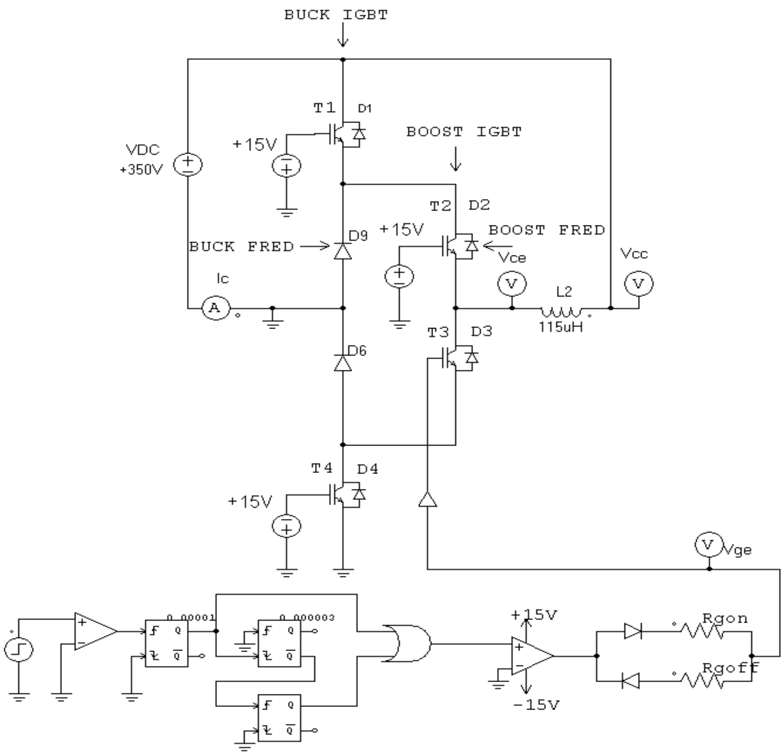


P_{rec} (100%) =	35,15	kW
E_{rec} (100%) =	2,37	mJ
t_{Erec} =	0,57	µs

Measurement circuit

Figure 11

BOOST stage switching measurement circuit



Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing, solder pin	10-F106NIA100SA-M135F	M135F	M135F
without thermal paste 17mm housing, pressFIT pin	10-P106NIA100SA-M135FY	M135FY	M135FY
without thermal paste 12mm housing, solder pin	10-FY06NIA100SA-M135F08	M135F08	M135F08

0

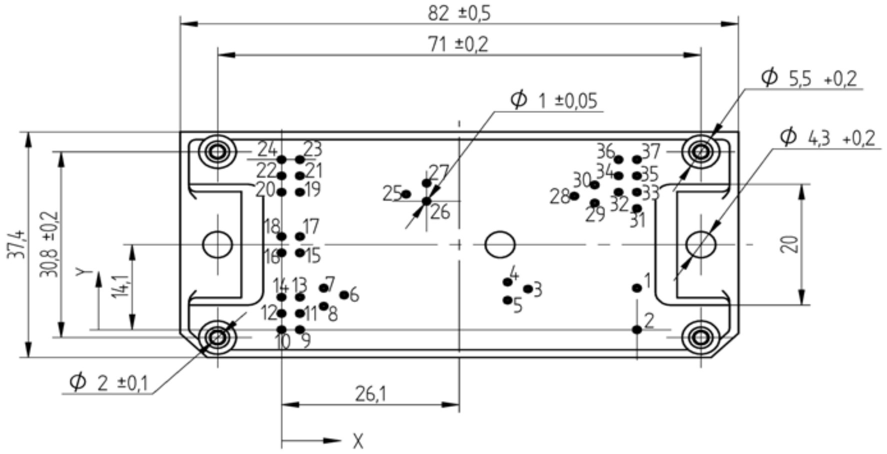
Outline

Pin table

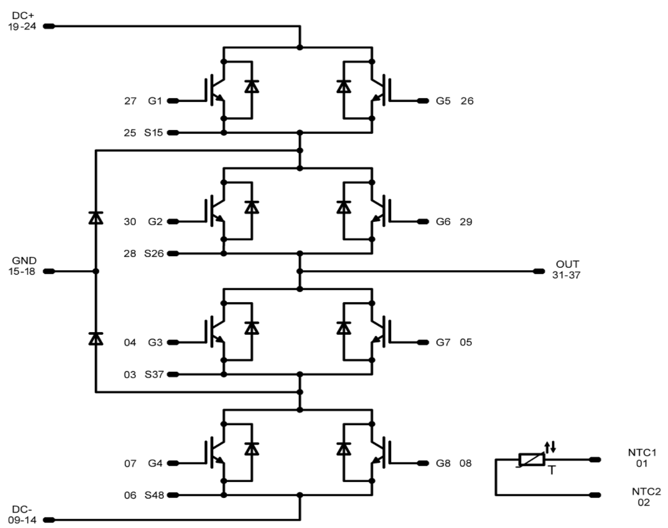
Pin	X	Y
1	52,2	6,9
2	52,2	0
3	36,2	6,75
4	33,2	7,9
5	33,2	4,9
6	9,2	5,75
7	6,2	6,9
8	6,2	3,9
9	2,7	0
10	0	0
11	2,7	2,7
12	0	2,7
13	2,7	5,4
14	0	5,4
15	2,7	12,75
16	0	12,75
17	2,7	15,45
18	0	15,45
19	2,7	22,8

Pin table

Pin	X	Y
20	0	22,8
21	2,7	25,5
22	0	25,5
23	2,7	28,2
24	0	28,2
25	18,3	22,45
26	21,3	21,3
27	21,3	24,3
28	43	22,15
29	46	21
30	46	24
31	52,2	20,1
32	49,5	22,8
33	52,2	22,8
34	49,5	25,5
35	52,2	25,5
36	49,5	28,2
37	52,2	28,2



Pinout



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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.