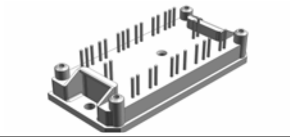
Vincotech

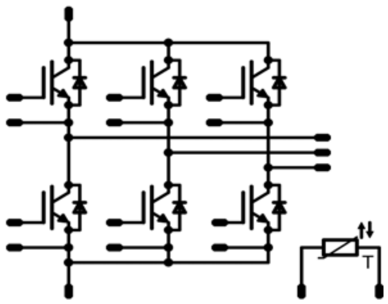
V23990-P825-F10-PM
preliminary datasheet

flowPACK 1 3rd gen	600V/100A

Features
- Compact flow1 housing
- Compact and Low Inductance Design
- Built-in NTC

flow1 housing


Target Applications
- Motor Drive
- Power Generation
- UPS

Schematic


Types
- V23990-P825-F10

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Transistor					
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	70	A
Repetitive peak collector current	I_{Cpulse}	t_p limited by $T_j$max	T_h=80°C T_c=80°C	300	A
Power dissipation per IGBT	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	107	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
Inverter 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	59	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	T_h=80°C T_c=80°C	300	A
Power dissipation per Diode	P_{tot}	$T_j=T_j$max	T_h=80°C T_c=80°C	72	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…+150	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Insulation Properties				
Insulation voltage	V_{is}	t=1min	4000	V_{DC}
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm

Characteristic Values

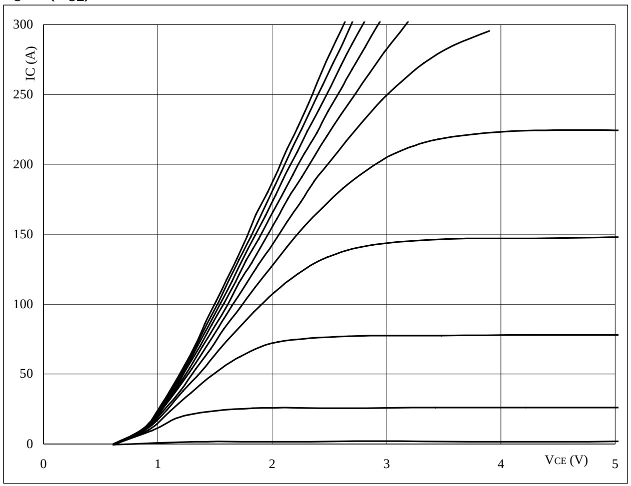
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Inverter Transistor										
Gate emitter threshold voltage	$V_{GE(th)}$	VCE=VGE			0,0016	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		100	Tj=25°C Tj=150°C	1,1	1,54 1,76	2,25	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,66	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			650	nA
Integrated Gate resistor	R_{gint}							2		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=4 Ω Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C		151 157		ns
Rise time	t_r					Tj=25°C Tj=150°C		19 25		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		205 232		
Fall time	t_f					Tj=25°C Tj=150°C		89 101		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,34 2,00		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		2,35 3,11		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		6160		pF
Output capacitance	C_{oss}							384		
Reverse transfer capacitance	C_{rss}							183		
Gate charge	Q_{Gate}	Vcc=480V	±15		100	Tj=25°C		625		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,89		K/W
Inverter Diode										
Diode forward voltage	V_F				100	Tj=25°C Tj=150°C	1,2	1,65 1,53	2,4	V
Peak reverse recovery current	I_{RRM}	Rgon=4 Ω	±15	300	100	Tj=25°C Tj=150°C		97 117		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		140 292		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		4,87 10,01		nC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		6149 3433		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		1,03 2,25		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,31		K/W
Thermistor										
Rated resistance	R_{25}	Tol. ±5%				Tj=25°C	4,2	4,7	5,8	kΩ
Deviation of R100	$D_{R/R}$	R100=435Ω				Tc=100°C		2,6		%/K
Power dissipation given Epcos-Typ	P					Tj=25°C		210		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3530		K

Output Inverter

Figure 1 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

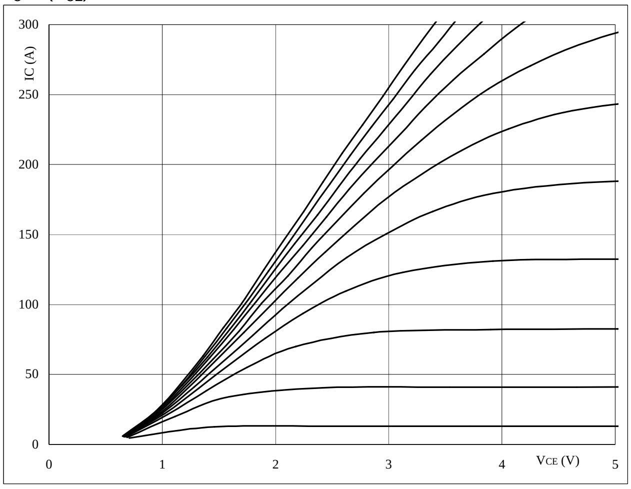
t_p =	250	µs
T_j =	25	°C

VGE from 7 V to 17 V in steps of 1 V

Figure 2 Output inverter IGBT

Typical output characteristics

$I_C = f(V_{CE})$



At

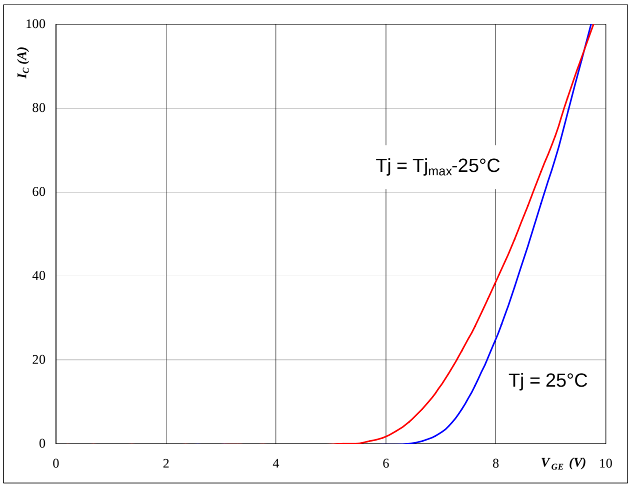
t_p =	250	µs
T_j =	150	°C

VGE from 7 V to 17 V in steps of 1 V

Figure 3 Output inverter IGBT

Typical transfer characteristics

$Ic = f(V_{GE})$



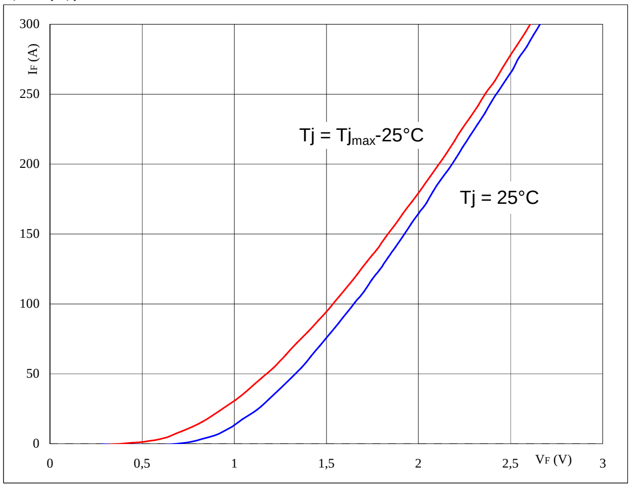
At

t_p =	250	µs
V_{CE} =	10	V

Figure 4 Output inverter FRED

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

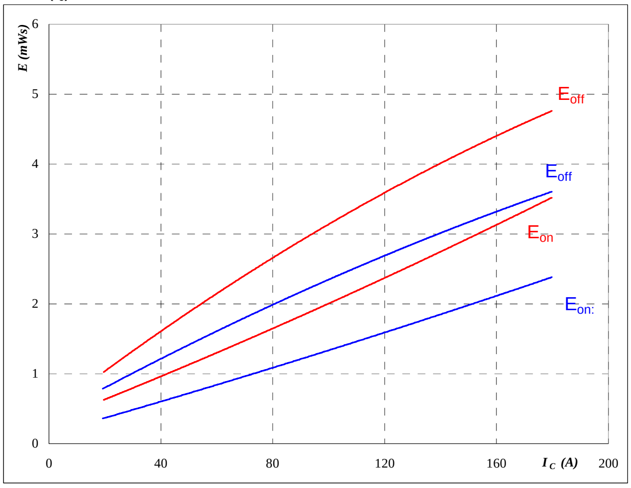
t_p =	250	µs

Output Inverter

Figure 5	Output inverter IGBT

Typical switching energy losses as a function of collector current

E = f(I_c)



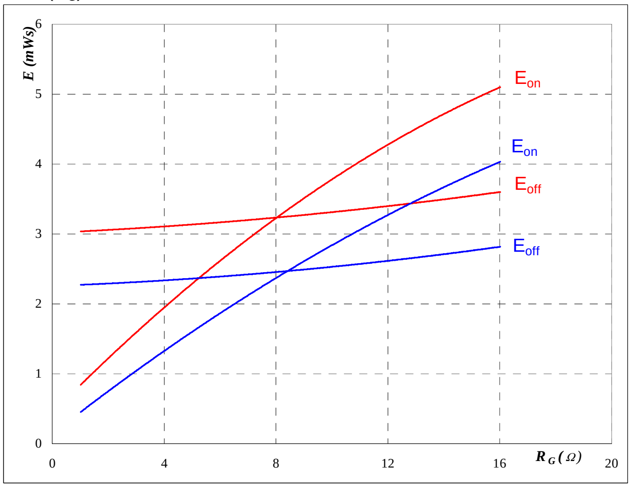
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6	Output inverter IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_G)



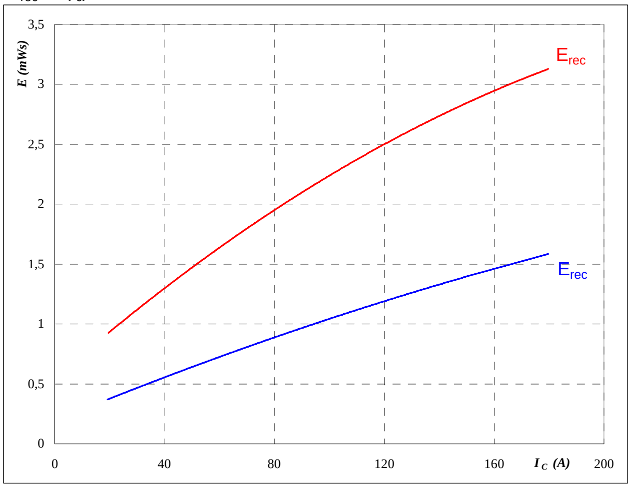
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 7	Output inverter IGBT

Typical reverse recovery energy loss as a function of collector current

E_{rec} = f(I_c)



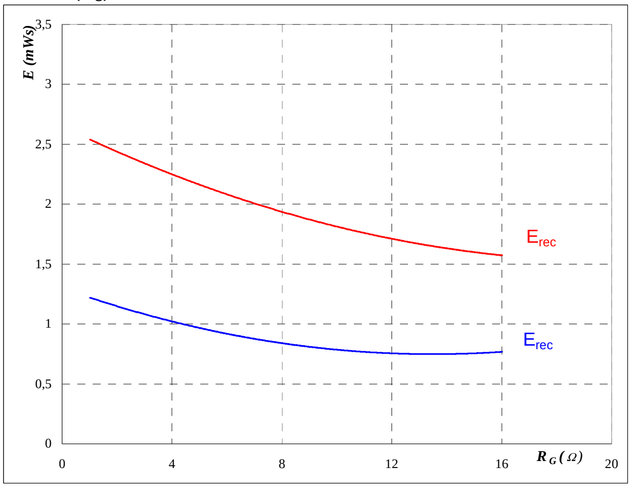
With an inductive load at

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 8	Output inverter IGBT

Typical reverse recovery energy loss as a function of gate resistor

Erec = f(R_G)



With an inductive load at

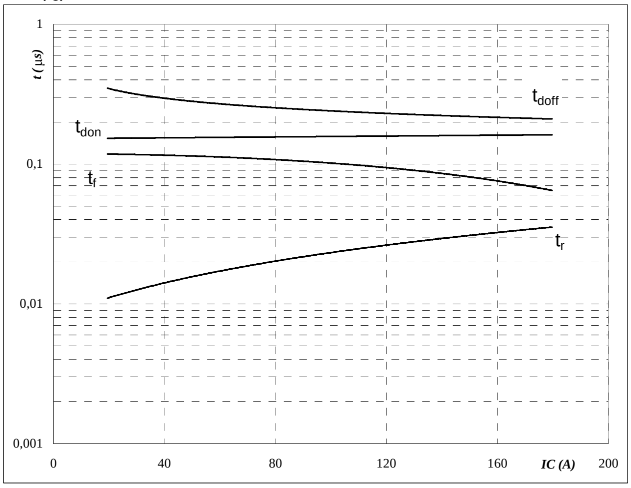
T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Output Inverter

Figure 9 Output inverter IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



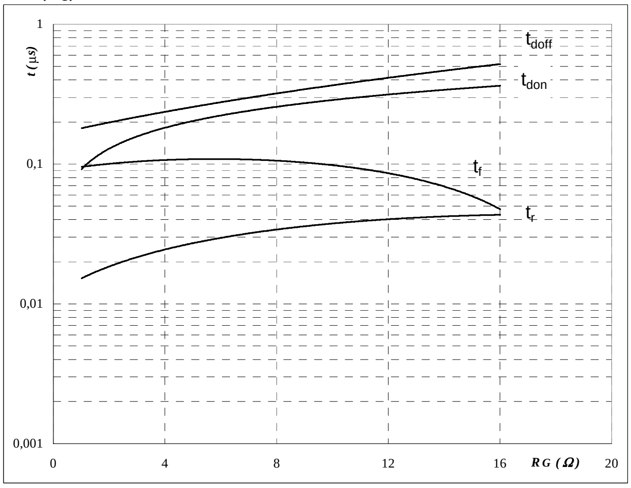
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 Output inverter IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



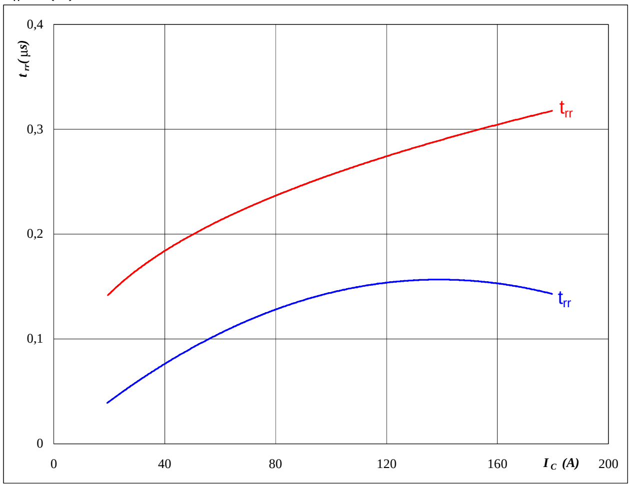
With an inductive load at

T_j =	150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
I_C =	100	A

Figure 11 Output inverter FRED

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



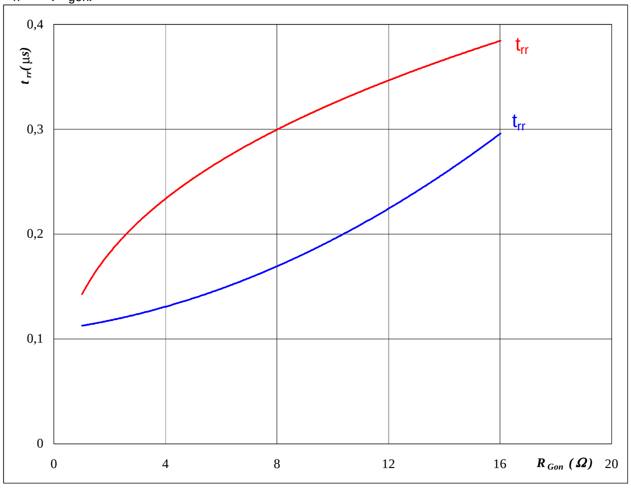
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 12 Output inverter FRED

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

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



At

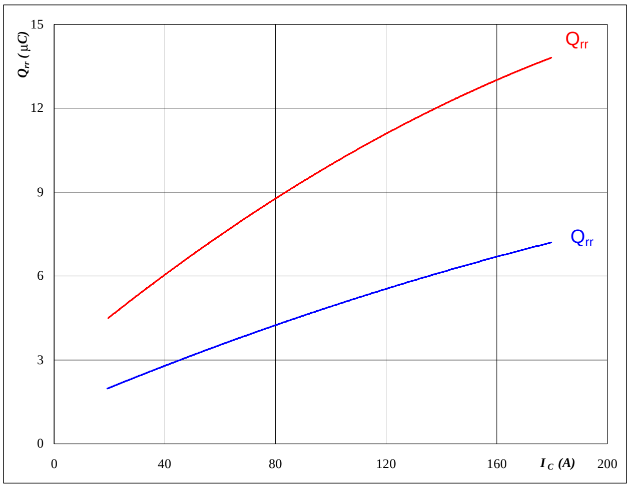
T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 13 Output inverter FRED

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(Ic)$



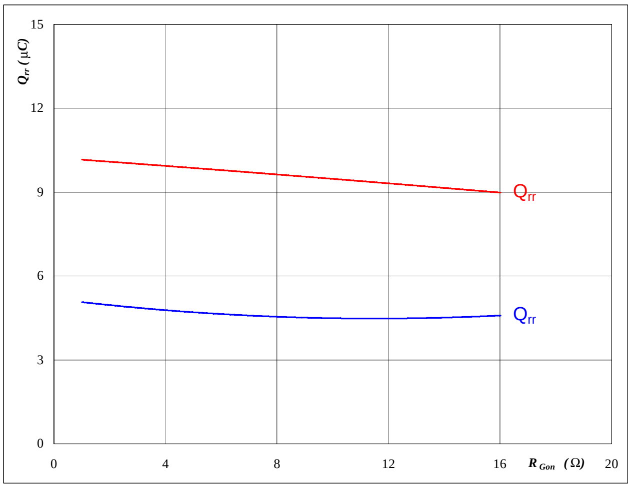
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 14 Output inverter FRED

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

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



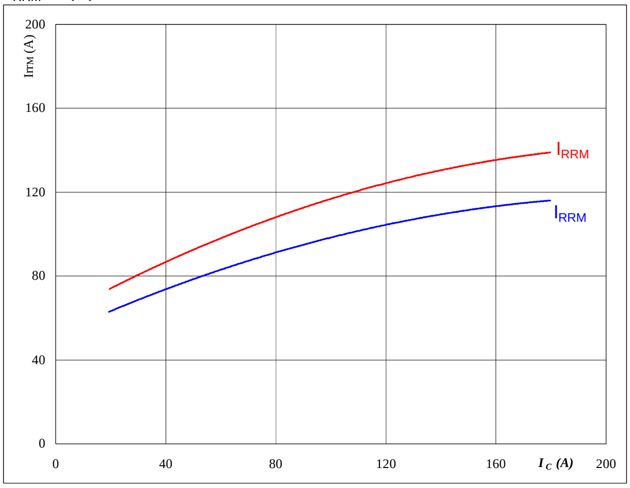
At

T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Figure 15 Output inverter FRED

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(Ic)$



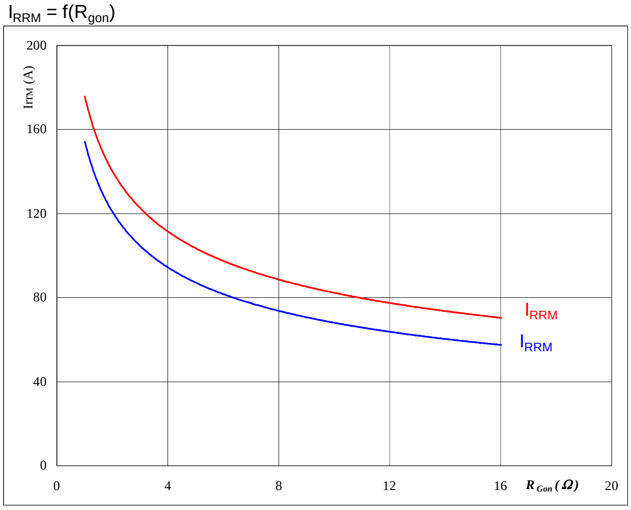
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 16 Output inverter FRED

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

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



At

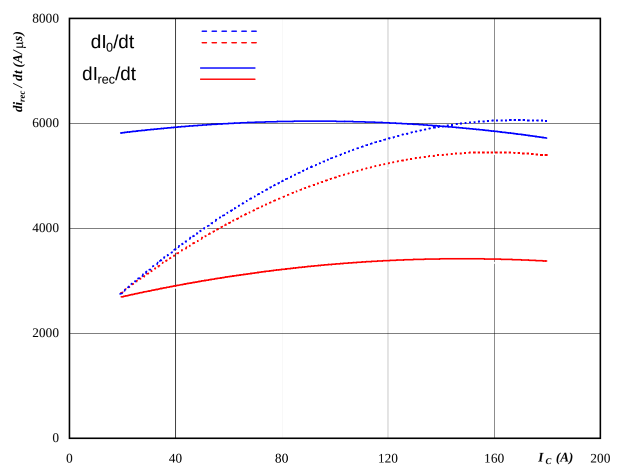
T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Output Inverter

Figure 17 Output inverter FRED

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

dI0/dt,dIrec/dt = f(Ic)



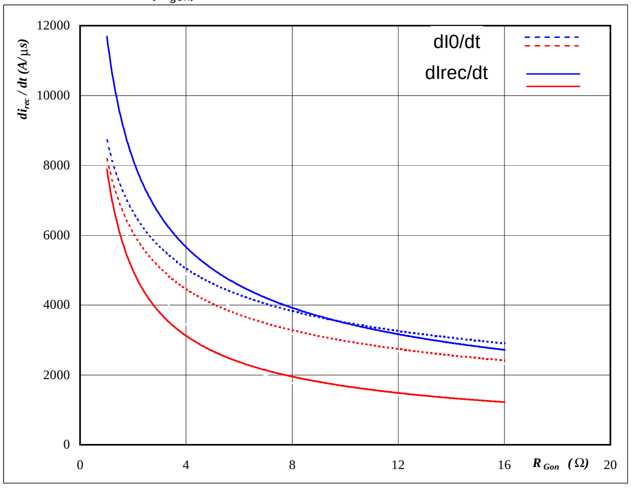
At

T_j =	25/150	°C
V_{CE} =	300	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

Figure 18 Output inverter FRED

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

dI0/dt,dIrec/dt = f(R_{gon})



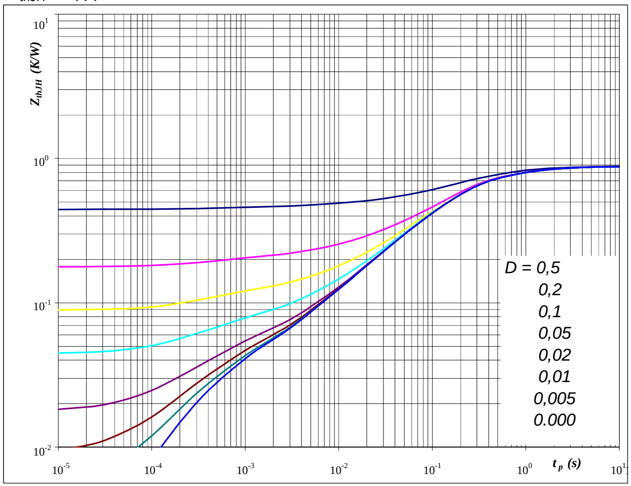
At

T_j =	25/150	°C
V_R =	300	V
I_F =	100	A
V_{GE} =	±15	V

Figure 19 Output inverter IGBT

IGBT transient thermal impedance as a function of pulse width

Z_{thJH} = f(tp)



At

D =	tp / T	
R_{thJH} =	0,89	K/W

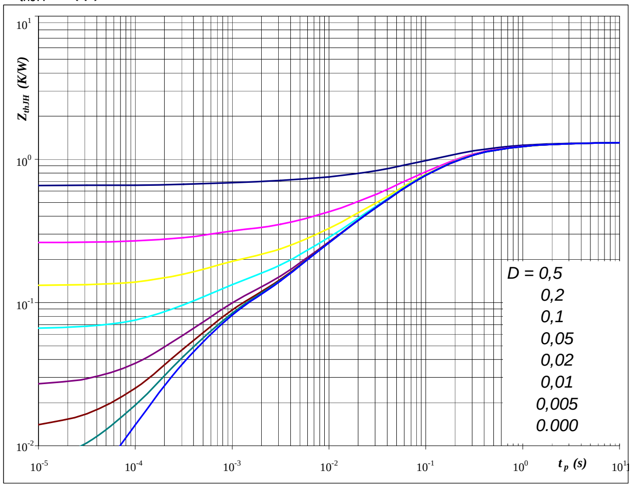
IGBT thermal model values

R (C/W)	Tau (s)
0,03	9,9E+00
0,15	1,1E+00
0,51	1,9E-01
0,14	3,2E-02
0,03	4,7E-03
0,03	3,9E-04

Figure 20 Output inverter FRED

FRED transient thermal impedance as a function of pulse width

Z_{thJH} = f(tp)



At

D =	tp / T	
R_{thJH} =	1,31	K/W

FRED thermal model values

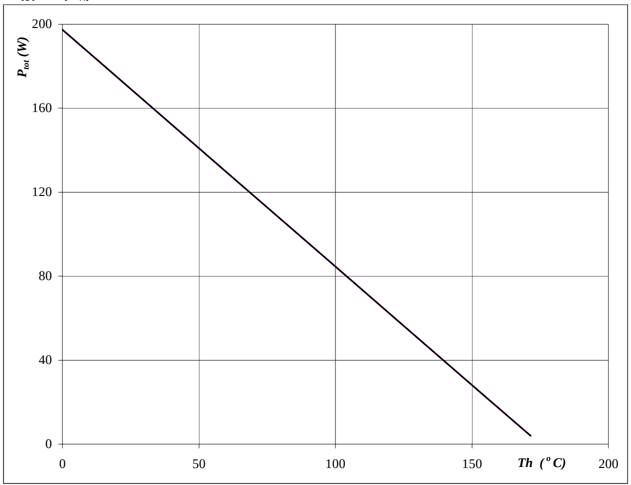
R (C/W)	Tau (s)
0,02	9,9E+00
0,15	1,2E+00
0,59	1,8E-01
0,35	4,7E-02
0,13	8,1E-03
0,07	5,3E-04

Output Inverter

Figure 21 Output inverter IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



At

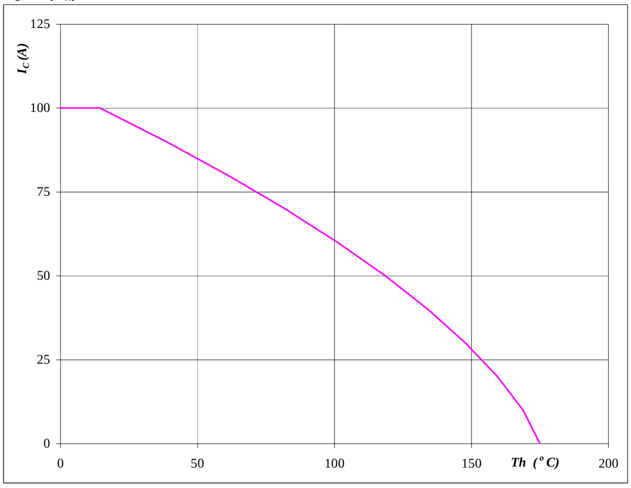
T_j = 175 °C

single heating
overall heating

Figure 22 Output inverter IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



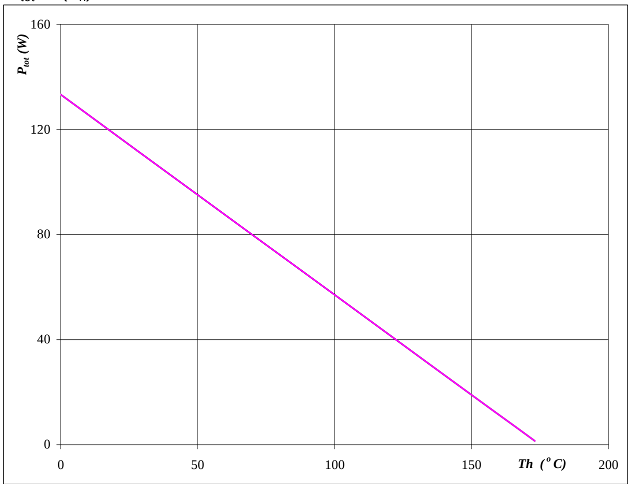
At

T_j = 175 °C
V_{GE} = 15 V

Figure 23 Output inverter FRED

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



At

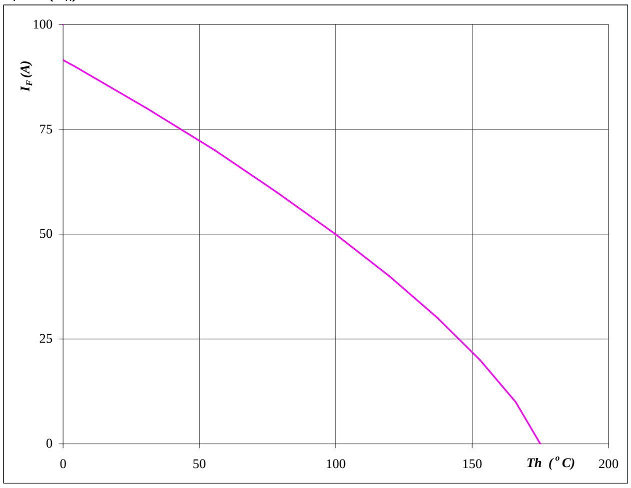
T_j = 175 °C

single heating
overall heating

Figure 24 Output inverter FRED

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

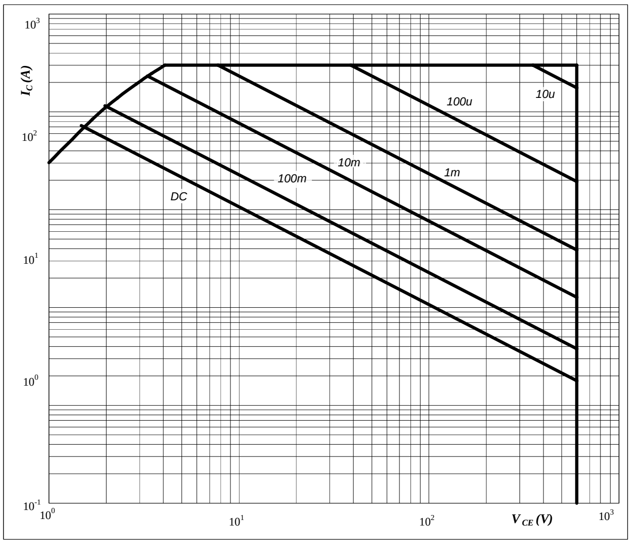
T_j = 175 °C

Output Inverter

Figure 25	Output inverter IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



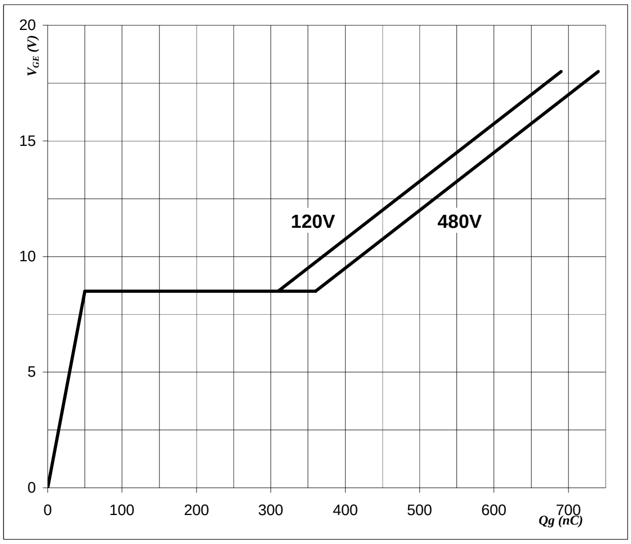
At

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

Figure 26	Output inverter IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Qg)$



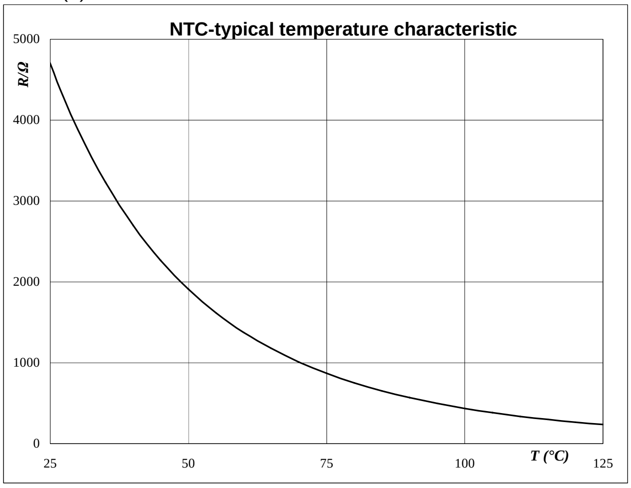
At

I_C =	100	A

Thermistor

Figure 1	Thermistor

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



Switching Definitions Output Inverter

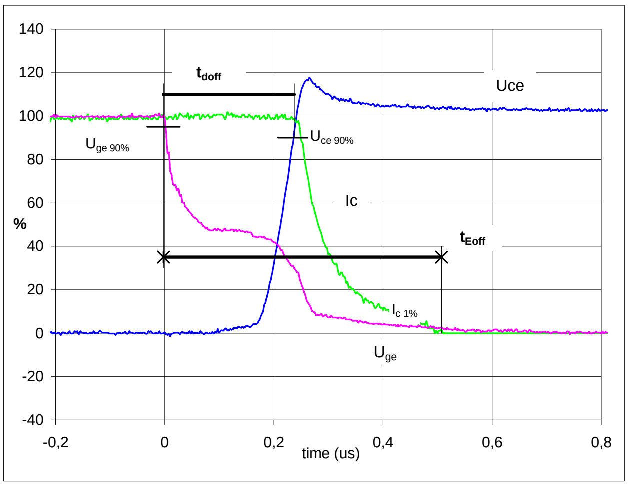
General conditions

T_j	=	150 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 Output inverter IGBT

Turn-off Switching Waveforms & definition of tdoff, tEoff

(t_{Eoff} = integrating time for E_{off})

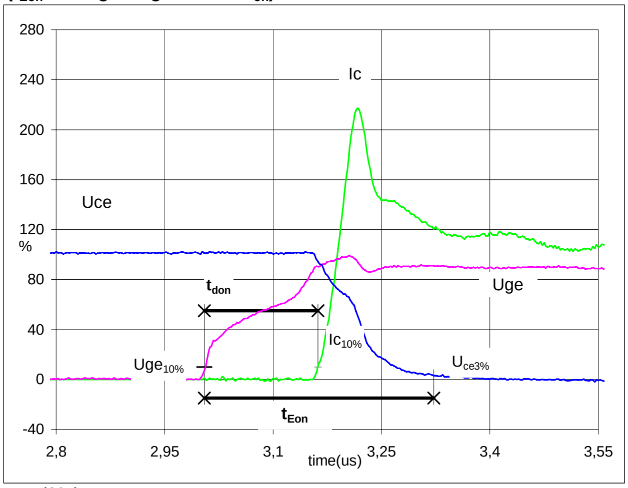


V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
t_{doff} =	0,23	µs
t_{Eoff} =	0,51	µs

Figure 2 Output inverter IGBT

Turn-on Switching Waveforms & definition of tdon, tEon

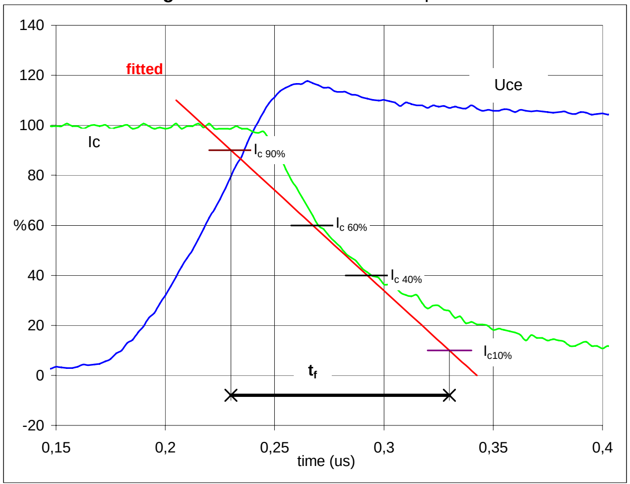
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
t_{don} =	0,16	µs
t_{Eon} =	0,32	µs

Figure 3 Output inverter IGBT

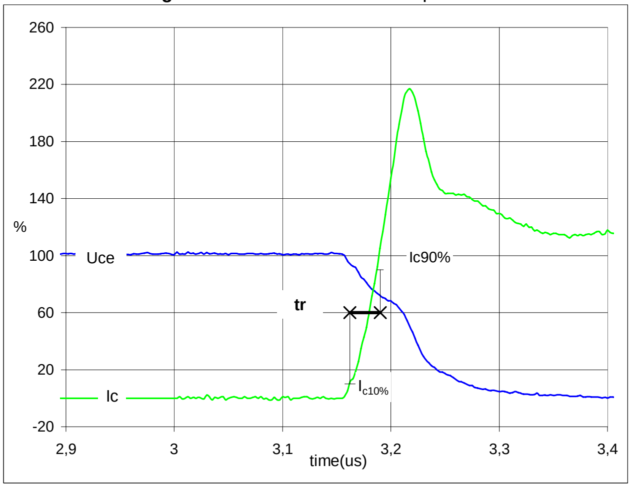
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	300	V
I_C (100%) =	99	A
t_f =	0,10	µs

Figure 4 Output inverter IGBT

Turn-on Switching Waveforms & definition of t_r

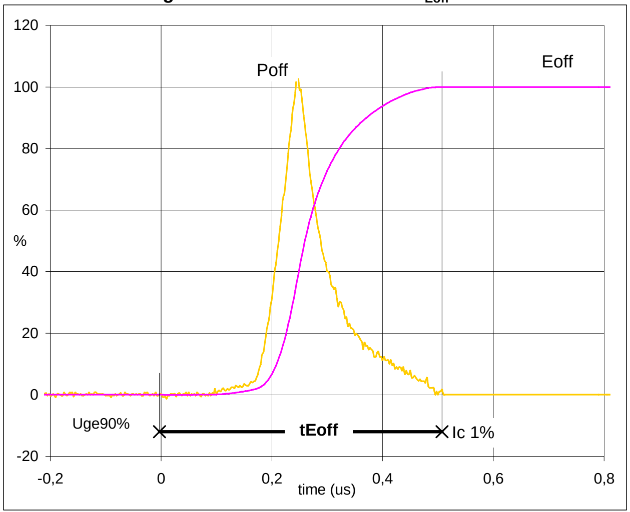


V_C (100%) =	300	V
I_C (100%) =	99	A
t_r =	0,03	µs

Switching Definitions Output Inverter

Figure 5 Output inverter IGBT

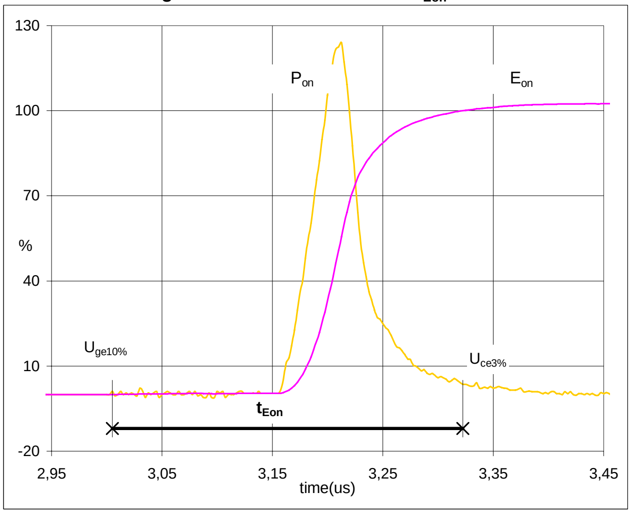
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	29,79	kW
E_{off} (100%) =	3,11	mJ
t_{Eoff} =	0,51	μs

Figure 6 Output inverter IGBT

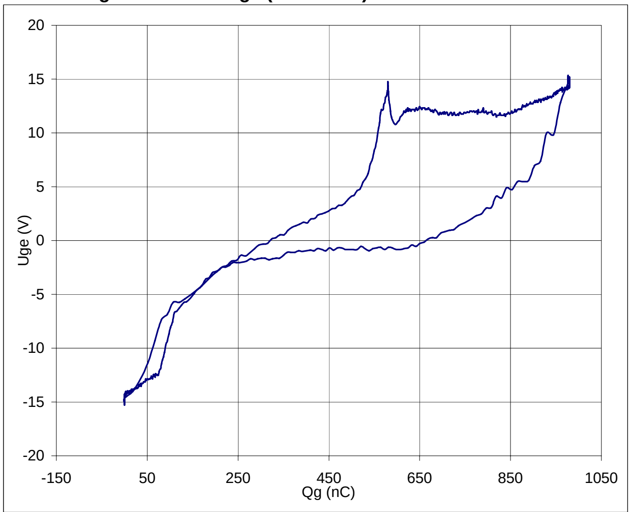
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	29,79	kW
E_{on} (100%) =	2,00	mJ
t_{Eon} =	0,32	μs

Figure 7 Output inverter FRED

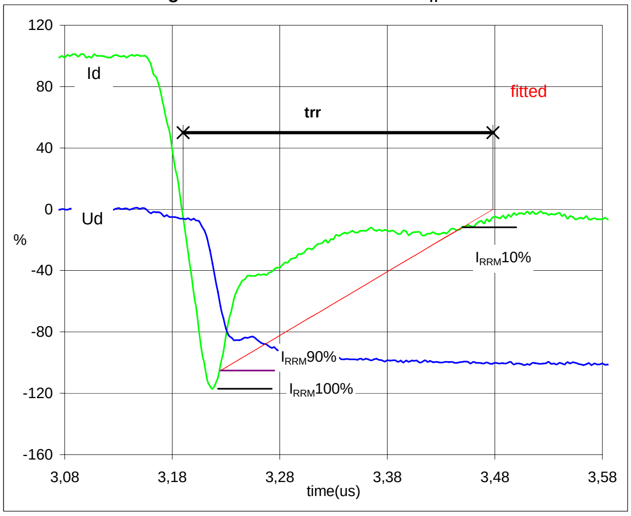
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	300	V
I_C (100%) =	99	A
Q_g =	979,79	nC

Figure 8 Output inverter IGBT

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

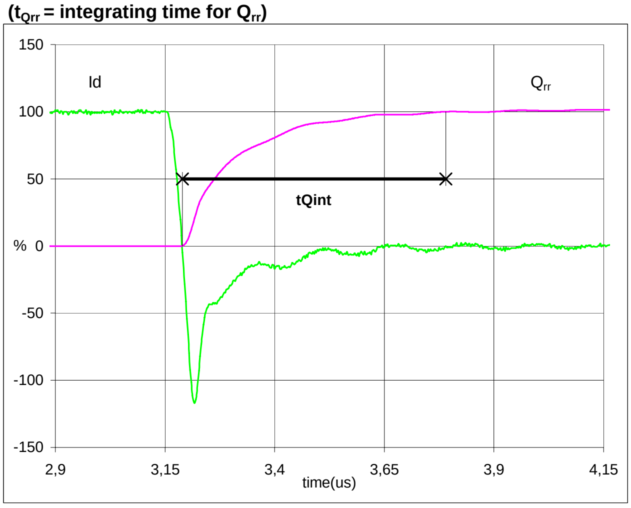


V_d (100%) =	300	V
I_d (100%) =	99	A
I_{RRM} (100%) =	-117	A
t_{rr} =	0,29	μs

Switching Definitions Output Inverter

Figure 9 Output inverter FRED

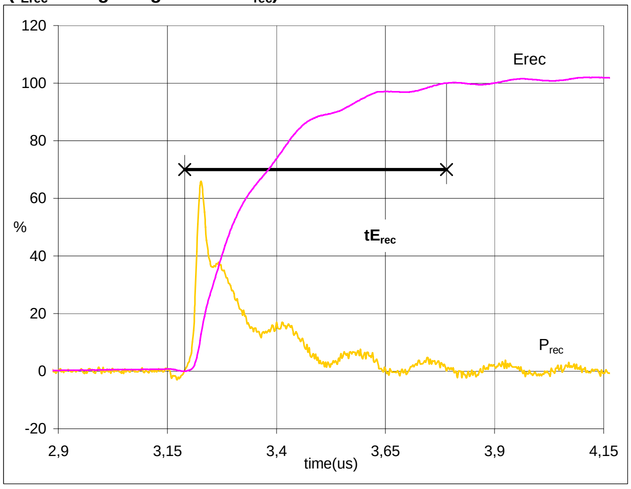
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	99	A
Q_{rr} (100%) =	10,01	µC
t_{Qint} =	0,60	µs

Figure 10 Output inverter FRED

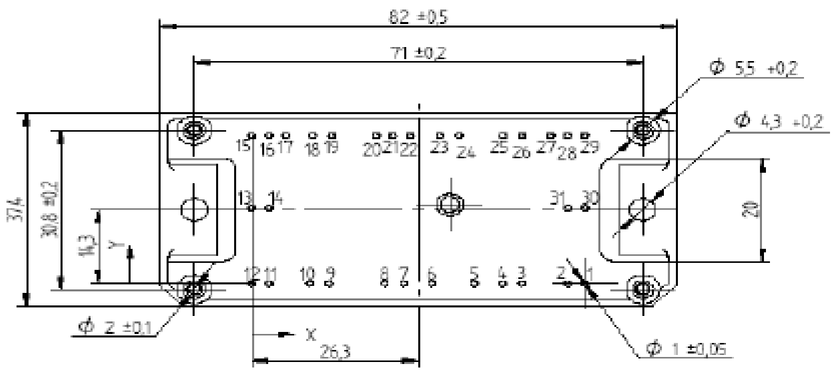
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	29,79	kW
E_{rec} (100%) =	2,25	mJ
t_{Erec} =	0,60	µs

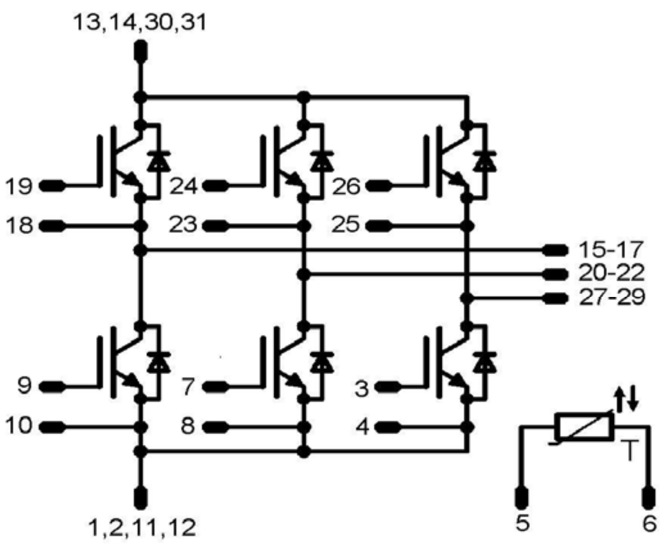
Package Outline and Pinout

Outline



Pin Table											
Pin	X	Y	Pin	X	Y	Pin	X	Y	Pin	X	Y
1	52,6	0	9	12,2	0	17	5,4	28,6	25	39,7	28,6
2	49,9	0	10	9,2	0	18	9,6	28,6	26	42,7	28,6
3	42,65	0	11	2,7	0	19	12,6	28,6	27	47,2	28,6
4	39,65	0	12	0	0	20	19,6	28,6	28	49,9	28,6
5	35,15	0	13	0	14,65	21	22,3	28,6	29	52,6	28,6
6	28,4	0	14	2,7	14,65	22	25	28,6	30	52,6	14,65
7	24	0	15	0	28,6	23	29,7	28,6	31	49,9	14,65
8	21	0	16	2,7	28,6	24	32,7	28,6			

Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.